FRED Reports

FRED 1991 ANNUAL REPORT
TO THE ALASKA STATE LEGISLATURE

Edited by
J. S. Holland, Ph.D.
Marianne McKean

Number 117

Alaska Department of Fish & Game
Division of Fisheries Rehabilitation,
Enhancement and Development

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Alaska Department of Fish and Game
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Carl L. Rosier
Commissioner

Jeffery P. Koenings
Director

P.O. Box 25526
Juneau, Alaska 99802-5526

January 1992

Alaska. Division of Fisheries Rehabilitation, Enhancement and Development.

Annual report 1991... Division of Fisheries Rehabilitation, Report to the Alaska State Legislature FRED Report, Division of Fisheries Rehabilitation, Enhancement and Development (FRED). 1991 - Juneau, Alaska: Alaska Department of Fish and Game, Division of Fisheries Rehabilitation, Enhancement and Development (FRED),

v. : ill. : 28 cm. annual.

Description based on: 1979. Continues: Alaska. Dept. of Fish and Game. Annual Report.

Vols. for 1991 - edited by J. S. Holland, Ph.D., Marianne McKean

Alaska--Periodicals. 3. Pacific salmon--Periodicals. I. Title.

639/.3/0979819

SH35.A62A4
81-640900

PUBLICATION ABSTRACT

TITLE/SUBTITLE

FRED 1991 Annual Report to the Alaska State Legislature
FRED Technical Report Series No. 117

ABSTRACT *(100 words maximum)*

FRED's major objectives are the rehabilitation, enhancement, development, protection, and maintenance of the salmon, trout, sheefish, and grayling resources of the state for the use of all Alaskans. To accomplish these, FRED utilizes hatcheries, stream rehabilitation, lake stocking, lake enrichment, and fishways as its basic tools. Hatcheries are about eight times more efficient in converting eggs to fish than the natural environment, fishways open new spawning areas to anadromous fishes, and the restoration of stream and lake environments rehabilitate wild fish populations. FRED's Limnology, Coded-Wire Tag Processing, Genetic, and Pathology Laboratories continue to provide important information on the state's fishery resources. FRED encourages rehabilitation efforts by private nonprofit aquaculture associations and provides technical services to them.

Over 1.7 billion salmon eggs were collected for hatcheries in the State of Alaska during 1991 through the combined efforts of the FRED Division and private nonprofit hatchery operators.

During 1991 FRED released more than 248 million juvenile fish. Approximately 337.7 million eggs were taken for incubation during the year, and over 9.2 million salmon and trout returned in 1991 as a result of FRED projects.

Private nonprofit hatcheries throughout the state released over 1 billion salmon and collected over 1.3 billion salmon eggs in 1991. An estimated 39.2 million adult salmon returned in 1991 as a result of private nonprofit hatchery operations.

Used as a proactive form of management, FRED Division program initiatives reach beyond the success of the finfish program to restore populations of crab, to implement programs required by the struggling mariculture (shellfish and aquatic plant) industry, and to develop rural economics through developing fisheries.

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SUBJECT CATEGORY

- [X] NATURAL RESOURCES
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- [ ] TRANSPORTATION
- [ ] LAW ENFORCEMENT
- [ ] COMMERCE & INDUSTRY
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- [ ] LOCAL GOVERNMENT
- [ ] OTHER

DOCUMENT CATEGORY

- [X] PERFORMANCE REPORT
- [ ] FINANCIAL REPORT
- [ ] PLANNING DOCUMENT
- [ ] GRANT APPLICATION
- [ ] PROMOTIONAL BROCHURE
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- [X] RESEARCH–STATISTICAL
- [ ] TRAINING MANUAL
- [X] EDUCATIONAL/GENERAL INFORMATION
- [ ] REGULATIONS/RIGHTS
- [ ] RECOMMENDED LEGISLATION
- [ ] OTHER

AGENCY *(Dept./Div./Program)* Dept. of Fish & Game, Div. of Fisheries Rehabilitation, Enhancement and Development

AGENCY ADDRESS P.O. Box 25526, Juneau, Alaska 99802-5526

SPONSORING AGENCY *(IF APPLICABLE)*

AGENCY CONTACT FOR MORE INFORMATION Jeffery P. Koenings, Director 465-4160

PERSONAL AUTHOR/EDITOR *(IF APPLICABLE)* J. S. Holland, Marianne McKean, Editors

REPORTING PERIOD	PUBLICATION DATE
1991	January 1992
DUE DATE	**DATE RECEIVED**
January 1992	
STATUTORY AUTHORITY	**FEDERAL AUTHORITY *(IF APPLICABLE)***
AS 16.05.092	

DOCUMENT FORMAT

- [X] NARRATIVE
- [ ] FINANCIAL STATEMENTS
- [X] MAPS
- [ ] STATISTICAL CHARTS
- [ ] PHOTOGRAPHS/ILLUSTRATIONS
- [ ] COMPUTER PRINT-OUT
- [ ] BIBLIOGRAPHY
- [ ] OTHER

PURCHASE PRICE (IF APPLICABLE)

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PREFACE

Enhanced salmon production in Alaska has existed for one century. In 1891, the 2.5 million sockeye salmon eggs that were incubated in troughs and baskets at a small hatchery on Karluk Lake (Kodiak Island) resulted in a release of 500,000 fish. After one year of operation, however, the Karluk Hatchery was closed because of disagreements between supporting canneries. Thereafter, hatcheries were built throughout the state by canneries as a tradeoff for the overharvesting of natural runs. Since those historic beginnings, much has changed, especially the principles surrounding responsible salmon enhancement.

In response to public concern over depressed fish stocks and an accompanying mandate to restore these fish without jeopardizing natural stocks, the modern-day fisheries restoration/ enhancement program was initiated in 1971. Furthermore, Alaskans overwhelmingly approved bond issues in 1976 and 1978 to provide capital to construct hatcheries around the state, leaving little doubt as to the value Alaskans place on their fisheries.

Stories and dogma surrounding hatcheries, especially salmon hatcheries, have grown out of the experience of our neighbors in Washington and Oregon, where the habitat supporting the enormous salmon runs of the Columbia River was traded off for electricity. Hatcheries today, it seems, take the blame for that choice. Later, when hatcheries had been built to mitigate that tradeoff, fish were moved without regard to disease concerns or to the mixing of stocks. After a while, the correlation of the spread of fish disease with the movement of fish within hatcheries became evident, as hatcheries demonstrated that large numbers of fish could be lost to disease; however, *hatcheries* in and of themselves did not cause anything. It was *people* who did the deeds—who traded electricity for fish, and who later, once hatcheries were in place, operated them without paying close attention to disease and genetic considerations.

In Alaska, the cause for initiating the hatchery program was depressed stocks. Nothing was traded off. When Alaska's salmon enhancement program got rolling, the FRED Division wrote and—with the concurrence of the Alaska Board of Fisheries—put into place the nation's toughest set of regulations governing the transportation, release, and possession of fish for aquaculture purposes.

First and foremost, the regulations prohibited the importation of finfish. Secondly, the regulations wove together a mixture of fish disease and fish genetics considerations that would be used to govern the movement of salmon for brood stock creation at hatcheries and for release locations of hatchery fish. These regulations prohibited the random movement of finfish throughout the state. A permitting system was established to carry out the regulations. With these basic safeguards in place, Alaska has developed one of the most successful fishery enhancement programs in the world.

As we move into the 1990s, new roles and responsibilities are developing for the FRED Division—the focus moving from production facilities to fisheries rehabilitation and economic development. Additional resources are being directed toward rehabilitating streams that have been damaged by mining, logging, and other developmental activities. New staff positions have been created to concentrate these efforts in places such as Nome and Prince of

Wales Island. Using hatcheries, limnology/biology, genetics, and pathology, the FRED Division provides fish to users in locations where they were never previously available. This acts as a management tool by (1) providing fish when natural production is low, (2) taking pressure off of wild stocks by moving some of the user effort to other areas, and (3) providing population estimates and migration patterns and timing through the use of fish marking. In fact, the preponderance of information on stock movements has been accumulated because of and since the FRED Division's origin.

When it first became apparent that successful enhancement might alter traditional management programs, insightful people began to develop deliberate strategies using enhancement as a management tool. Fisheries development and rehabilitation programs in many areas help to relieve the fishing pressure on more fragile wild stocks and accelerate wild stock restoration. Three of the most graphic examples involve FRED programs at Homer Spit and Crooked Creek, the Chena River, and Karluk Lake (mentioned previously as the site of Alaska's first hatchery). The extremely successful chinook salmon programs at Homer Spit and Crooked Creek have reduced the sport fishing pressure on more fragile south Kenai Peninsula wild stocks. With extremely depressed chinook salmon runs to the Kenai River and resulting closures, sport fishermen have focused on these newly developed runs.

The Chena River near Fairbanks once supported the world's largest grayling sport fishery. Overharvest of this wild stock a decade ago led to severe population declines and very restrictive management in recent years. The Sport Fish Division has concluded that even with severe area and time restrictions, it could take 20-30 years to restore the Chena River Arctic grayling population and fishery. As such, the FRED and Sport Fish Divisions are now jointly pursuing an aggressive 4-year restoration program through the Clear Hatchery.

Upon closure of the Karluk Hatchery in 1891, a fisheries agent predicted that "unless the Karluk Hatchery is established, in addition to protective means, red salmon will be exterminated."[1] Karluk Lake sockeye salmon populations were not exterminated, but they fell to dangerously low levels and for 60 years would not respond to traditional management techniques. A cooperative sockeye salmon restoration program was established in 1985; through lake enrichment techniques, this progress has resulted in self-sustaining sockeye salmon populations of between 2.2 and 2.5 million in 1990 and 1991, representing the highest returns of Karluk Lake sockeye salmon since the early 1920s.

The FRED Division provides a deliberate, proactive component to management when simple time and area closures are not enough. The division provides fish to be caught while protecting endangered natural stocks or provides harvestable stocks so that managers can spread out the fishing effort in sport or commercial fisheries. Although the strategy of using enhancement techniques on a management tool is still young, it has been successfully used by both commercial and sport fish managers to solve problems and meet resource goals.

Fisheries enhancement in Alaska has come a long way since 1891; it means far more today than just the fish hatcheries of the early 1900s. It means fishpasses and lake enrichment. It means rigorous and responsible disease and genetic regulations. It means proactive fisheries

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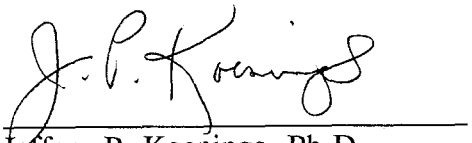
[1] Roppel, Patricia. 1982. *Alaska's Salmon Hatcheries 1891-1959.* National Marine Fisheries Service, Portland, Oregon.

management. And, most importantly, it means abundant fish in the hands of the fishermen of Alaska.

As director, I would like to recognize the many FRED Division staff members that contributed their ideas and insightfulness to this preface.



Jeffery P. Koenings, Ph.D.
Director
ADF&G, FRED Division

CHAPTER 1

FRED DIVISION BACKGROUND

The Fisheries Rehabilitation, Enhancement and Development (FRED) Division of the Alaska Department of Fish and Game (ADF&G) plays a major role in the state's salmon management program. Its purpose is to sustain and enhance Alaskan fisheries through the development and application of technologies in supplemental production and natural stock rehabilitation. The division's roles are: Development of new enhancement technology; hatchery production for sport, subsistence, and non-cost-recovery commercial fisheries; technical services; habitat restoration and fisheries rehabilitation; regulation and management of the Private Nonprofit (PNP) Program; administration of the department's mariculture program; and statewide program coordination, including production, planning, and technology transfer. As such, it **contributes knowledge** gained from tagged-fish studies and technological research; it **mitigates fish losses** from foreign interceptions and environmental disruptions; it **contributes fish** to existing but depressed fisheries; it **creates new opportunities** for commercial, sport, and subsistence fisheries and rural economic diversification; it **develops and provides** new technology and expertise for the expansion of mariculture, fish marking, and stock identification; and it **aids other aspects** of the statewide enhancement program through technical services and PNP Program coordination.

Statutory Authorities

The mission of the FRED Division is to plan and implement a program that ensures the perpetual and increasing production and use of Alaska's fisheries resources (AS 16.05.092). Its statutory direction is broad enough to include species other than salmon, such as king crab, halibut, black cod, scallops, mussels, and marine plants. In addition, employees of the FRED Division, with approval of the ADF&G Commissioner's Office, coordinate the rehabilitation and enhancement activities of the department and regional aquaculture associations (AS 16.10.380), process fish transport permits and applications for PNP hatcheries (AS 16.10.440), and coordinate fish resource (e.g., scientific/educational) permits. The division also technically assists the PNP hatcheries to the extent possible (AS 16.10.443) and cooperates in the development of regional salmon plans (AS 16.10.375).

The Aquatic Farm Act of 1988 encourages the establishment and responsible growth of an aquatic farm industry. The FRED Division is also required to develop a disease management and control program for aquatic farms and hatcheries (AS 16.40.150), review suitability of proposed aquatic farms or hatcheries (AS 16.40.105), and ensure that the proposed farm does not significantly alter traditional fisheries or adversely affect fisheries, wildlife, or their habitats (AS 16.40.105).

The FRED Division's duties (AS 16.05.092) also include the annual presentation of a comprehensive annual report to the Alaska State Legislature. This report, along with a detailed budget request, satisfies the division's reporting requirements.

Functions and Services

The FRED Division operates 14 hatcheries to produce salmonid fishes for subsistence, commercial, and sport fisheries. Fishpasses located throughout the state provide spawning and rearing habitat that would otherwise be unattainable to salmon stocks. The FRED Division maintains many of these fishpasses cooperatively with the U.S. Forest Service (USFS). The strategies of lake fertilization, habitat improvement, and fish-stock introduction are being more widely used to provide improved freshwater survival and new production opportunities for salmon stocks.

The FRED Division operates 5 laboratories that serve ADF&G, other governmental agencies, and PNP operators. The Fish Pathology Section has two laboratories, one in Anchorage and one in Juneau, and provides diagnostic services and brood stock evaluation for both state and PNP fisheries programs. The Limnology Section has a laboratory in Soldotna and supervises all lake-enrichment projects and analyses of water quality, plankton, and in-lake fish populations sampled for lake-productivity studies. The Coded-Wire Tag Processing Laboratory decodes metal tags implanted in fish and supplies resultant information for hatchery and natural-stock evaluation as well as for evaluation of U.S./Canada salmon interceptions. The Genetic Laboratory monitors the interaction of hatchery salmon stocks with wild hatchery salmon and employs genetic techniques for finfish and shellfish-stock identification and stock improvement.

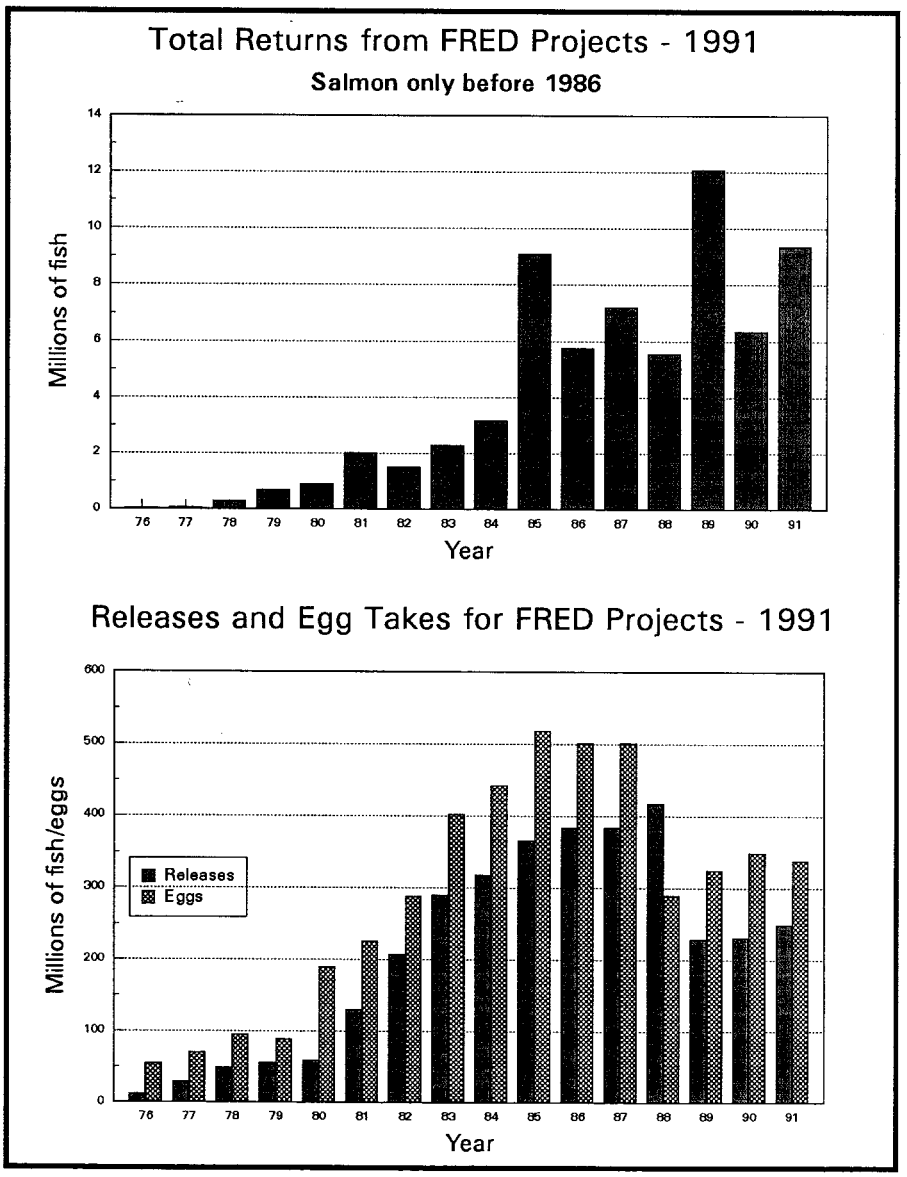
The PNP Program is administered by the FRED Division. One responsibility of administering this program is to organize the regional salmon planning teams that are comprised of ADF&G and regional aquaculture association members. The PNP Program Office coordinates the review of PNP hatchery applications and the permitting process, which includes hatchery, fish transport, and fish resource (scientific/educational) permits.

The FRED Division administers the department's mariculture program. Mariculture administration, permitting, technical assistance, and research coordination are major components of the division's mariculture program. The program continued in 1991 with 56 permitted farms in the state and 42 proposed farms pending final permit action. Species farmed and/or being proposed for farming include oysters, mussels, scallops, abalone, clams, and a number of types of aquatic plants.

CHAPTER 2

FRED PRODUCTION SUMMARY

Total production for FRED Division salmon-enhancement projects in 1991 was over 9.2 million salmon and more than 100,000 other salmonids (Figure 2.1). This is an increase of nearly 50% over the corresponding return in 1990. This increase reflects several things: A basic run failure of pink salmon at the Kitoi Bay Hatchery in 1990 with a rebound of the stock in 1991 to more than twice its 1990 return. Yet the pink salmon cycle of odd- and even-year returns is not the total story for the 1991 increased production rate. A record return of over 2.5 million sockeye salmon occurred at the Karluk Lake project in 1991. Sockeye salmon returns to Main Bay Hatchery jumped from 9,000 to over 484,000 for 1991. There were other increases, including pink salmon returns to fishways in Southeast and coho salmon to Klawock Hatchery, which contributed to the overall increase. However, the major thrust confirms the FRED Division's success in its sockeye salmon-production progam. Sockeye salmon were made a priority for FRED Division production in the mid-1980s, and that effort is showing great success.



Figures 2.1 and 2.2.

Releases of fish from FRED Division facilities totaled over 248 million in 1991 (Figure 2.2), an increase of more than 16 million from 1990. Major increases in releases occurred at Kitoi Bay and Sikusuilaq Springs Hatcheries; the release of pink salmon from Kitoi Bay being almost 39 million greater than the previous year and nearly 1 million more chum salmon being released from Sikusuilaq Springs Hatchery. All other regions and all species except pink salmon showed decreases in release numbers in 1991. This trend in decreasing release numbers

will continue until the effects of transferring hatcheries to the private sector are completed and the numbers leveling off to a sustainable level.

Egg-take information provided in Figure 2.2 shows a slight decrease in number of eggs taken for FRED Division activities in 1991. Almost 338 million eggs were taken in 1991 compared to 348 million in 1990. Pink, coho, and sockeye salmon had decreases in eggs taken while chinook and chum salmon had increased numbers. Egg-take numbers are generally guided by brood stock availability, program direction, and budgetary realities.

CHAPTER 3

SOUTHEAST

Summary of FRED Projects

The FRED Division has 3 area offices and operates 4 hatcheries in southeast Alaska. Two additional state-owned hatcheries in the Southeast Region are operated by regional aquaculture associations under contract with the state. Area offices are located in Juneau, Petersburg, and Ketchikan. State-operated hatcheries in southeast Alaska include: Snettisham, approximately 40 miles south of Juneau; Crystal Lake, on the road system outside of Petersburg; Deer Mountain in Ketchikan; and Klawock on Prince of Wales Island, near the community of Klawock (Figure 3.1). Hidden Falls Hatchery, on the east side of Baranof Island, is owned by the state and operated under contract by the Northern Southeast Regional Aquaculture Association (NSRAA). Beaver Falls Hatchery, on the road system out of Ketchikan, is owned by the state and operated by the Southern Southeast Regional Aquaculture Association (SSRAA). In southeast Alaska and other regions of the state, the FRED Division uses hatcheries as primary tools for fisheries enhancement while employing other technologies, such as fishpasses, spawning channels, lake fertilization, lake and stream stocking, and habitat restoration, in ever increasing numbers.

Southern Southeast:

Deer Mountain Hatchery, located in Ketchikan's City Park, produces chinook and coho salmon and steelhead and rainbow trout primarily intended for local sport fisheries. The hatchery is also a site for research that helps to optimize fisheries projects statewide. Interacting with tourists is an important role for Deer Mountain Hatchery staff, as an estimated 195,000 visitors toured the facility during the summer of 1991.

Program direction at Deer Mountain Hatchery is shifting away from remote releases and placing more emphasis on developing urban, sport fisheries, fisheries education, and research. This year Deer Mountain Hatchery continued its investigation of using triploid (sterile) chinook salmon as an enhancement tool. The possible benefits of triploids include (1) an increase in longevity in the marine environment, (2) retention of brightness, and (3) homing to a terminal area without actually ascending streams to mix with wild stocks. Performance of triploid chinook salmon with respect to freshwater rearing and marine survivals is being investigated.

Yearling steelhead trout smolts were produced at Deer Mountain Hatchery for the second year in a row in a program funded by Federal Aid in Sport Fish Restoration Act (Wallop-Breaux [W-B]) monies. The final month of rearing in salt water (Thomas Basin net pens) gave the trout a needed growth surge, and 5,000 fish were released. This is the first time in Alaska that steelhead trout have been reared in salt water prior to release.

W-B monies have allowed a research/enhancement project to start that may greatly benefit the Ketchikan area. Triploid rainbow trout eggs were obtained from the state-owned Fort

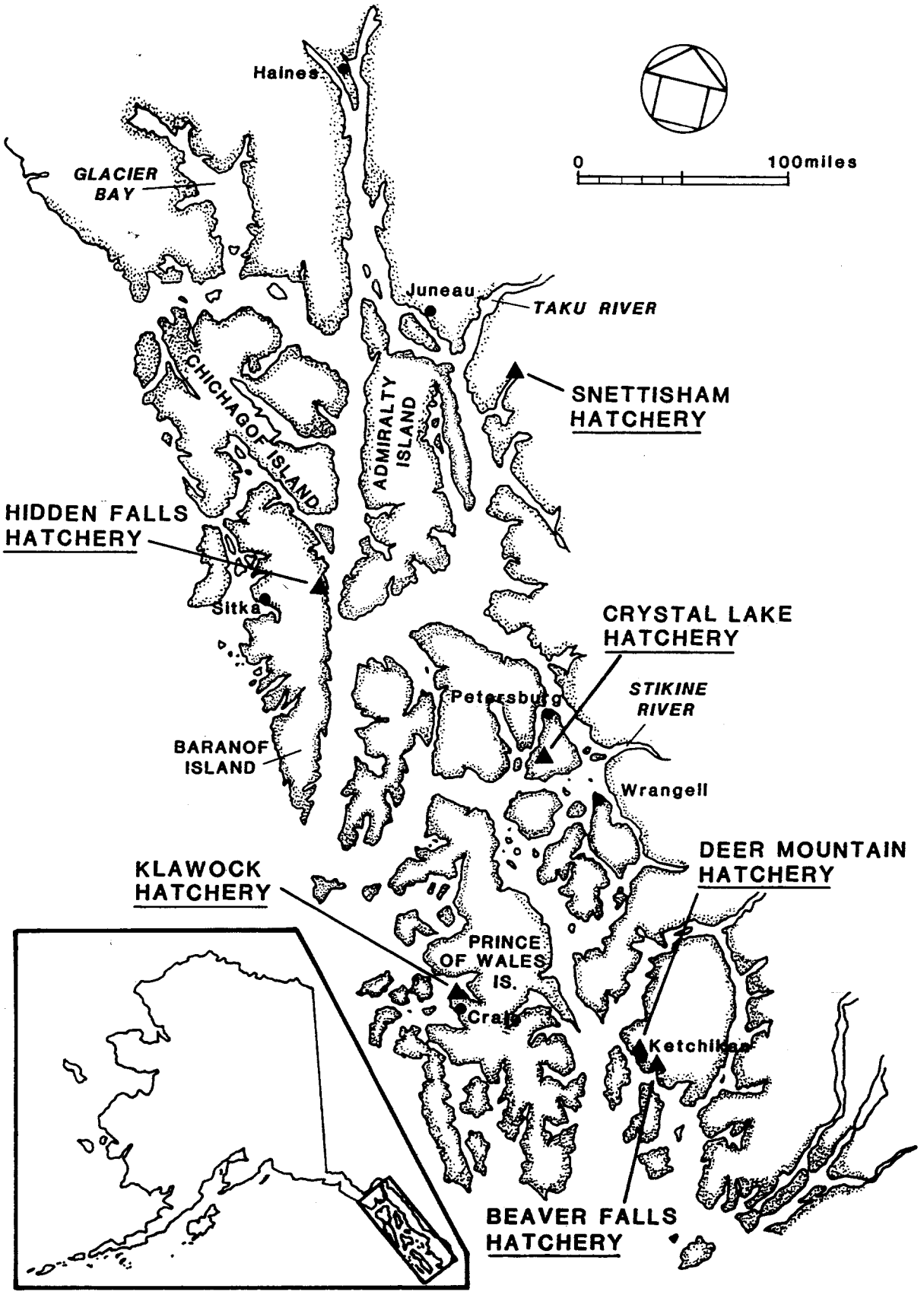


Figure 3.1. Map of Southeast.

Richardson Hatchery Broodstock Development Center near Anchorage, and 5,500 fingerlings were released in Carlanna Lake, adjacent to Ketchikan's city limit. Followup trapping will provide data on survival of triploids as well as on the interaction of enhanced triploid and resident rainbow trout. In addition, this project has potential for creating important recreational fisheries for Ketchikan and other urban areas. Another 1,000 triploid rainbow trout continue to rear at Deer Mountain Hatchery and will be used for a Kids' Fishing Day in City Park next spring.

The basic mission of the **Klawock Hatchery**, located on Prince of Wales Island, is being reexamined in light of the FRED Division's present program emphasis. Production of coho salmon, most of which are commercially harvested, has been the core of the Klawock program for a number of years.

A team of regional, area, and hatchery staff met for 2 days at Klawock Hatchery in the summer of 1991 to assess the facility's role. During that meeting, the following hatchery goals were defined: (1) Work toward full production from the Klawock Lake watershed on a self-sustaining basis; and (2) fully utilize Klawock Hatchery as a resource in achieving the first goal and in bioenhancing and rehabilitating projects in other Prince of Wales Island drainages.

The first goal, a self-sustaining fish population in Klawock Lake, calls for rehabilitation of the sockeye salmon population. Although historic runs of 100,000 sockeye salmon have been reported, the 1991 escapement was estimated at 3,900 (up from 1,600 in 1990). The hatchery is reducing the number of coho salmon presmolts planted in Klawock Lake to reduce the likelihood of predation on sockeye salmon fry.

Progress toward the second goal has been underway for several years, as the hatchery has provided coho salmon for colonization above three fishpasses constructed by the USFS. In addition, steelhead trout smolts from the hatchery have been planted to enhance the populations in Klawock River and Ward Creek on Revillagigedo Island.

A new facet for the Klawock Hatchery steelhead trout program was planting 1,000 two-year-old fish in landlocked One Duck Lake for a Kids' Fishing Derby during National Fishing Week. The derby drew 300 local children for a day of fishing. The USFS and ADF&G Sport Fish and FRED Divisions cooperated to make this a highly successful event. Local residents continued to fish in One Duck Lake throughout the year.

Limited brood stock is the most critical problem facing the Klawock Hatchery sockeye salmon program. This year, for the first time, a group of 20,000 sockeye salmon is being reared to the presmolt stage and will be released into Klawock Lake by the end of 1991. Presmolt releases should help maximize survival, thereby increasing the brood stock supply more rapidly than would releases at an earlier life stage.

The second limiting factor for the sockeye salmon program is the hatchery's supply of pathogen-free water. Rearing over 20,000 sockeye salmon to the presmolt stage will require additional water, if the present level of other programs require this water be maintained.

Northern Southeast:

Crystal Lake Hatchery is located 17.5 miles south of Petersburg on Mitkof Highway. Crystal Lake Hatchery began operation in 1972 and is designed for long-term rearing of salmon and trout. In 1978 it was thoroughly disinfected because of bacterial kidney disease (BKD) and susceptibility to infectious hematopoietic necrosis (IHN) virus in the chinook salmon stock. New local stocks of eggs were imported. Andrew Creek, a tributary of the Stikine River, was the choice for chinook salmon, and Duncan Salt Chuck on Kupreanof Island the choice for coho salmon. The steelhead trout came from Falls Creek on Mitkof Island, about 7 miles north of the hatchery.

Long-term annual hatchery-production objectives for Crystal Lake are to rear 1.3 million chinook salmon smolts and 100,000 coho salmon smolts for a return of 60,000 adult chinook salmon and 6,000 adult coho salmon, respectively. The steelhead trout program at Crystal Lake Hatchery is being modified toward research to determine best release sizes and timing for this species. In addition to smolt production, three isolation modules are capable of incubating 200,000 eggs and rearing 100,000 fry to 1 g, or 12,000 smolts to 10 g. The original three isolation modules are presently used for chinook salmon stream-bioenhancement projects. A fourth isolation module is being constructed to bioenhance cooperative fishway projects with NSRAA, SSRAA, and the USFS. In a cooperative project with SSRAA and the USFS, 500,000 chinook salmon smolts from Crystal Lake Hatchery are taken to the Earl West Cove remote-release site on an annual basis.

Crystal Lake Hatchery is the major chinook salmon brood source for both state and PNP hatcheries in northern southeast Alaska, but this role should diminish as each hatchery generates its own return.

Chinook salmon production from Crystal Lake will peak by the mid-1990s at about 60,000 adults per year. This is 22% of the chinook salmon enhancement goal established in the Southeast Comprehensive Salmon Plan. Though Crystal Lake Hatchery is located within the boundary established for southern southeast Alaska planning, these fish will primarily be harvested in northern southeast Alaska waters.

The **Snettisham Hatchery** is located at the head of Snettisham Arm in Port Snettisham, approximately 30 air miles southeast of Juneau. This facility is located at the outfall of a large hydroelectric-generating station that provides the majority of the City and Borough of Juneau's electricity. Snettisham Hatchery was first operational in 1981, although pilot studies started in 1976. In 1984 CIP funds were acquired to complete the initial phases of the hatchery. Incubation capacity is now 15 million sockeye salmon eggs and 5 million chinook salmon eggs.

While Snettisham Hatchery was originally designed to produce chum, coho, and chinook salmon, the program evolved to emphasize sockeye and chinook salmon. In part, this change was made possible by advances in technology of sockeye salmon that was pioneered by the FRED Division in southcentral Alaska. This technology, when coupled with the desire for increased production of this species in southeast Alaska and the mandates for mitigation brought by the U.S./Canada Pacific Salmon Treaty, made Snettisham the ideal site to produce sockeye salmon.

Sockeye salmon were first cultured at Snettisham Hatchery in 1988, and now replace chum salmon, the species the program formerly concentrated on producing. A sockeye salmon central incubation facility (CIF) is being incorporated into the central facility as part of the provisions of the U.S./Canada Pacific Salmon Treaty. A separate, temporary incubation area is currently being used for sockeye salmon culture at an interim level of 15 million eggs.

Snettisham is now in a transitional phase as the program adjusts to its new direction. The core components of the new Snettisham program are: (1) The incubation and planting of sockeye salmon on the Taku and Stikine Rivers for joint enhancement with Canada; (2) the incubation and planting of sockeye salmon in Alaskan lakes; and (3) the production of chinook salmon smolts for release in the Juneau area, and chinook salmon for the Twin Lakes catchable program and south Baranof Island. The sockeye salmon projects will benefit the gillnet fleet, while the chinook salmon projects will benefit the sport and troll fisheries.

The Snettisham Hatchery is also working toward the production of sockeye salmon smolts. Because of specialized techniques for this type of culture, the hatchery is being modified and plans to release its first group of smolts in 1994.

FRED Division personnel cooperated with other agencies, primarily the USFS and PNP hatchery operators, in many non-hatchery projects in 1991. **Fishpass** projects were particularly evident in the Southeast Region. Information on fishpass projects as well as lake and stream restoration projects are given in Chapter 9, Fish Habitat Restoration and Improvement.

Southeast Region personnel were active in providing aid to the private sector in 1991. One of the division's primary functions is to provide **technical assistance** and expertise on enhancement to other agencies and organizations, such as the USFS, PNP hatchery operators, regional aquaculture associations, teachers, and individuals with mariculture or school projects.

***Applied Research*:**

Another FRED Division strategy is to provide appropriate research so that enhancement, rehabilitation, and development activities can be optimized. Some of the research projects that are ongoing in Southeast are summarized below.

Triploid Chinook Salmon Research - A production group of 40,000 triploid chinook salmon is planned from the 1991 brood at Deer Mountain Hatchery. Detailed culture data are being collected, with 6 families tracked separately through incubation and rearing. Triploids and their sibling diploids will be reared separately for 3 of the families and reared together for the other 3 families. Use of passive induced transponder (PIT) tags will allow tracking of growth rates in some individual fish. This will be the second such release from Deer Mountain Hatchery; 15,000 were released from the 1987 brood.

Anti-BKD Diet Research - Presence of the causative agent for BKD in Deer Mountain Hatchery's water supply allows FRED Division personnel to head research projects aimed at learning to "farm around" this untreatable disease. The 1990 brood year

chinook salmon are involved in a test of the efficacy of two diets to produce BKD immunity.

Rearing-Density Research - Deer Mountain - Two years of freshwater rearing density research have been completed. The objective has been to determine how crowding affects subsequent marine survival of hatchery coho salmon planted in a lake as presmolts. It is possible that final rearing in a natural environment will mitigate the influence of previous crowding at the hatchery. In 1991 returns of the first groups showed similar contributions to marine fisheries between groups of fish reared at two rearing densities. If the 1992 returns confirm this trend, increased presmolt-rearing densities can be used, enabling the production of more fish.

Rearing-Density Research - Klawock - The culture phase of a coho salmon rearing density and age-at-release study involving 2 brood years (1988 and 1989) was completed in 1991. Some aspects of this study were complementary to the coho salmon-rearing density study at Deer Mountain Hatchery in Ketchikan. The most noteworthy feature of the culture of this brood was the appearance of BKD in the high-density smolt group. Although BKD has been documented in the Klawock Lake coho salmon brood stock, it had never been seen in rearing fish. Kidney tissue from random samples of both low- and high-density smolt groups was analyzed by the FRED Division's Fish Pathology Laboratory. The causative agent of BKD was found in 24% of the high-density fish and in none of the low-density fish.

Chilkat River Chinook Salmon Genetic Study - Due to concerns over the depressed status of Chilkat River chinook salmon, a program to determine the genetic variance in the population, and differences, if any, between spawning populations in different tributaries was initiated in 1991. Although the FRED Division led this effort, Sport Fish Division personnel collected many of the samples. Tissue samples were collected from spawning adults in 5 different locations on the Chilkat River. Those tissues were preserved in liquid nitrogen in the field and transferred to a super cold (-80°C) freezer in Juneau. The samples will be analyzed using starch-gel electrophoresis. Determinations will then be made on the population stock structure based on genetic relationships of the subpopulations. This information is critical to management and enhancement efforts with the Chilkat stock.

Cryopreservation of Chinook Salmon Milt Study - A decline in Chilkat River chinook salmon populations has led to a concern that genetic variability is being lost. In an effort to protect and preserve some of the genetic variability of these populations, milt from 23 chinook salmon males was cryopreserved in 1991. Cryopreserved milt could be used to reintroduce genetic variability to future generations of Chilkat River chinook salmon.

Snettisham Hatchery Photoperiod Study - Historically, chinook salmon growth rates at Snettisham Hatchery have been less than desired. It has been demonstrated through experimentation with other salmonid species that artificially extending the photoperiod during rearing can increase growth rates. An experiment was conducted at Snettisham in 1991 to determine if photoperiod manipulation could lead to increased growth of chinook salmon reared at Snettisham. Results look promising.

Southeast Highlights

- The development of a Chilkat River Chinook Salmon Plan has set a framework in place for addressing the decline of this important chinook salmon stock.

- The newly developed stream rehabilitation program continues to expand, prompting closer coordination with other agencies, such as the USFS and Alaska Department of Transportation and Public Facilities.

- To help preserve the genetic integrity of the declining Chilkat River chinook salmon, milt from 23 males was cryopreserved (frozen in liquid nitrogen) for the purpose of maintaining genetic variability of the stock. Tests of the viability of the milt indicate these efforts were highly successful.

- Juneau anglers caught a record 5,000 Snettisham Hatchery chinook salmon from the popular Twin Lakes sport fishery. Well over 1,000 anglers participated in the fishery. This project is a cooperative project with the Sport Fish Division and funded by W-B federal-aid monies.

- For the third year in a row, sockeye salmon from Snettisham Hatchery were planted in various transboundary rivers. This project marks the first production-scale use of the fish mass-marking technique of thermal tagging. Success of this program has been so evident to international scientists that the program has been expanded to Tuya Lake, which might eventually be stocked with as many as 15 million fry.

- In 1991 sport fishermen caught 1,300 fish (primarily in the roadside fishery) that were produced from the Pavlof River coho salmon project at Snettisham Hatchery. This represents an outstanding 8% return to the sport fish creel. Harvest timing was in July and early August, as desired. There was a very strong interest in these fish, as evidenced by harvest as well as level of effort at the return site.

- The most dramatic success story for sockeye salmon enhancement in southeast Alaska continues to be McDonald Lake, located north of Ketchikan. The production from lake fertilization (additional to what would have been produced without fertilization) contributed 69,500 sockeye salmon to southern Southeast commercial fisheries, or 6% of the entire seine and gillnet commercial sockeye salmon catch for the Southern Southeast Region. Approximately 5,000 McDonald Lake sockeye salmon were harvested by subsistence users, and 176,200 escaped to the lake to begin another cycle.

- The triploid rainbow trout program initiated at Deer Mountain Hatchery in 1991 will provide a new tool for southeast Alaska sport fish enhancement. The triploid rainbow trout may be planted in more locations because there is no danger that these sterile fish will harm the genetic integrity of the wild fish.

- Steelhead trout at Deer Mountain Hatchery were successfully reared in salt water for a month prior to release. This is the first time this strategy has been used in Alaska to enhance the survival of steelhead trout.

- Crystal Lake Hatchery provided more fish to southeast Alaska fisheries than ever before, an estimated 28,600 chinook salmon.

Southeast Returns and Fishery Contributions

Southeast divisional projects produced returns of over 1 million salmon in 1991 (Table 3.1A). A record catch of pink salmon in 1991 indicates there were more commercial net-fishery openings and, therefore, more opportunities to intercept production from FRED projects. State hatcheries contributed well to the various southern Southeast commercial, sport, subsistence, and personal-use fisheries in 1991.

Over half of 1991's enhanced production was of pink salmon returning to fish ladder projects built and/or maintained by the FRED Division. The odd-/even-year cycle in pink salmon production accounts for the tremendous increase in pink salmon produced in 1991 from FRED Division Southeast projects when compared to 1990. The dominant species after pink salmon continues to be sockeye salmon, with an increase in production of over 50,000 fish compared to 1990. The trend continues for the increasing production of sockeye salmon in southeast Alaska state enhancement projects; there will be major increases when sockeye salmon production from Snettisham Hatchery comes on line. Production of chinook and coho salmon were up significantly in 1991 as well.

FRED Division projects contributed 410,000 fish to the seine fishery, 212,000 fish to the gillnet fishery, 131,000 fish to the troll fishery (Table 3.1B), and 20,000 fish to the sport fishery.

Southeast Releases

The FRED Division released over 13.1 million salmonids from southeast Alaska enhancement projects in 1991 (Table 3.2). This represents a major decrease when compared to 1990 and 1989 release numbers. There are several primary causes for the continuing decrease in release numbers from Southeast state-operated facilities and projects. Beaver Falls Hatchery production, which included a release of over 4 million sockeye salmon in 1990, is now included in the PNP sector's release numbers, as the facility is now being operated by SSRAA. Another major cause is the species change from chum salmon dominance to sockeye salmon dominance, initiated in 1987. The diminishment or total loss of chum salmon production at several Southeast facilities has not yet been made up in sockeye salmon production. Both coho and chinook salmon releases were also low in 1991.

Southeast Egg Takes

The total number of eggs taken at Southeast FRED Division projects was lower in 1991 (almost 20 million eggs) than in 1990 (Table 3.3). Again the primary reason is that Beaver Falls Hatchery is no longer tabulated with state project numbers, as it is being operated by SSRAA, a PNP aquaculture association. Other factors, such as fewer-than-anticipated sockeye salmon brood at the Klawock Hatchery, also played a role in this decrease. Sockeye and chinook salmon egg numbers remained essentially the same at Snettisham, with a slight

Table 3.1A. Estimated contribution of fish by FRED hatcheries and projects in 1991.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis-tence	Brood Stock/ Escapeme	Total	Comments
ARCTIC-YUKON-KUSKOKWIM								
Clear Hatchery	Grayling		500				500	1990 SF harvest data
	A char		2,500				2,500	1990 SF harvest data
Ft Rich- Interior lakes	Rainbow		65,000				65,000	1990 SF harvest data
Big Lake- LL lakes	Coho		15,000				15,000	1990 SF harvest data
Sikusuilaq Hatchery	Chum	20,000	100		5,000	6,700	31,800	
AYK TOTALS:		20,000	83,100	0	5,000	6,700	114,800	
COOK INLET								
Big Lake Hatchery								
Big Lake	Sockeye	59,300		5,000		59,300	123,600	
	Coho	1,300				1,300	2,600	
Crooked Creek Hatchery								
Crooked Creek	Coho		1,655			3,085	4,740	
	Steelhead		200			90	290	
Tustumena Lake	Sockeye	125,000		2,800		73,000	200,800	
Leisure/Hazel L	Sockeye	117,000	5,000				122,000	35% of LCI sockeye
Chenik Lake	Sockeye	60,000	100			9,900	70,000	17% of LCI sockeye
Port Dick Lake	Sockeye	4,600					4,600	
Kirschner Lake	Sockeye	43,000					43,000	13% of LCI sockeye
Landlocked Lakes	Coho		500				500	1990 SF harvest data
Elmendorf Hatchery								
Crooked Creek	Chinook		4,800			1,340	6,140	
Halibut Cove	Chinook	420	2,250				2,670	
Homer Spit	Chinook		3,500				3,500	
	Coho		10,000	800			10,800	
Seldovia	Chinook	270	1,250				1,520	
Ship Creek	Chinook	130	445			800	1,375	
	Coho	410	818			200	1,428	

Table 3.1A. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis-tence	Brood Stock/ Escapeme	Total	Comments
Landlocked lakes	Coho		15,000				15,000	1990 SF harvest data
Resurrection Bay	Chinook		1,004				1,004	
	Coho		8,721				8,721	
Fort Richardson Hatchery								
Willow Creek	Chinook		800			300	1,100	
Ninilchik R	Chinook		1,924				1,924	
Little Susitna	Coho		6,600			8,400	15,000	
Cook Inlet lakes	Rainbow		61,000				61,000	1990 SF harvest data
	Chinook		6,800				6,800	1990 SF harvest data
Tutka Bay Hatchery								
Kachemak Bay	Pink	140,000	2,000			121,000	263,000	
	Chum	1,000				1,000	2,000	
Halibut Cove	Pink	60,000					60,000	
Homer Spit	Pink		500				500	
Clear Hatchery								
Landlocked lakes	Grayling		800				800	
	A Char		1,100				1,100	
COOK INLET TOTALS:		612,430	136,767	8,600	0	279,715	1,037,512	
KODIAK/ALASKA PENINSULA								
Kitoi Bay Hatchery	Pink	1,390,700				251,261	1,641,961	
	Chum	31,700				43,300	75,000	
	Coho	9,800	1,650		200	7,050	18,700	Anadromous returns only.
Port Lions	Coho				5,000		5,000	
Landlocked lakes	Coho		50				50	
	Rainbow		1,400				1,400	
Karluk	Sockeye	1,376,000			500	1,134,000	2,510,500	
Frazer fishpass	Sockeye	1,494,600				190,400	1,685,000	Fishpass

Table 3.1A. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis-tence	Brood Stock/ Escapeme	Total	Comments
Afognak Fishpasses	Coho					3,500	3,500	Fishpass
(combined)	Pink	2,200				36,500	38,700	Operated by Comm Fish
	Sockeye	32				8,703	8,735	Operated by Comm Fish
Waterfall Fishpass	Pink	6,900				115,000	121,900	Fishpass
Russell Creek Hatchery	Coho		500			1,500	2,000	
	Pink	6,900	200			30,200	37,300	
KODIAK/AK PEN TOTALS:		4,318,832	3,800	0	5,700	1,821,414	6,149,746	
PRINCE WILLIAM SOUND								
Fort Richardson Hatchery								
Cordova	Coho		10,000				10,000	
Gulkana Hatchery	Sockeye	122,500	111		17,690	82,399	222,700	Personal-use combined with subsis
Main Bay Hatchery	Chum	137,129					137,129	
	Sockeye	480,200				4,700	484,900	
PWS TOTALS:		739,829	10,111	0	17,690	87,099	854,729	
SOUTHEAST								
SOUTHERN								
Bakewell R	Sockeye	18,936				454	19,390	Fishpass
Dog Salmon R	Coho	60				100	160	Fishpass
Dog Salmon R	Pink	25,000				5,000	30,000	
Ketchikan Cr	Pink	222,600	4,000			40,000	266,600	Fishpass
Marx Cr Spwn Ch	Chum	163					163	
Margaret L	Sockeye	81				73	154	Fishpass
Sunny Cr	Pink	220,000				45,000	265,000	Fishpass
Beaver Falls Hatchery								
Hugh Smith L	Sockeye	8,331				5,994	14,325	
McDonald L	Sockeye	69,515	200		5,000	176,178	250,893	

Table 3.1A. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis-tence	Brood Stock/ Escapeme	Total	Comments
Deer Mountain Hatchery								
Big Salt L	Chinook	24	3				27	
Bold Island L	Coho	2,273	38				2,311	
Craig	Chinook	24					24	
Deer Mountain	Chinook	187	232			820	1,239	
	Coho	3,754	1,030			3,380	8,164	
Reflection L	Coho	175				220	395	
Thorne Bay	Chinook	12					12	
Ward Cr	Coho	1,651	776			1,154	3,581	
Klawock Hatchery								
Cable Cr	Coho	750				20	770	
Klawock	Coho	52,249	1,080			18,000	71,329	
Tunga L	Coho	6,410				25	6,435	
CENTRAL								
Irish Creek	Coho	34,100				500	34,600	Fishpass
Crystal Lake Hatchery	Chinook	10,400	3,820			3,550	17,770	
	Coho	2,930	320	210		3,160	6,620	
Earl West Cove	Chinook	13,600	590	50			14,240	
Ohmer Creek	Chinook	90	50				140	
Farragut	Chinook	17	1			8	26	
Harding River	Chinook	45	3			5	53	
Slippery Creek	Coho	490					490	
St. John's Creek	Coho	27					27	
NORTHERN								
Chilkat Ponds	Coho	1,000				200	1,200	

Table 3.1A. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis-tence	Brood Stock/ Escapeme	Total	Comments
Eliza Lake	Chinook	13					13	
Jerry Myers	Chinook	28	26			16	70	
	Coho	404				200	604	
Snettisham Hatchery								
Doty Cove	Chum	6,733					6,733	
Indian Lake	Coho	22				22	44	
Indian River	Chinook	8	15			35	58	
Limestone Inlet	Chum	13,613					13,613	Juneau/DJ = Fish Cr, Sheep Cr,
Juneau/DJ	Chinook	810	1,106			669	2,585	Montana Cr, Auke Cr,
	Coho	2,112	1,445			2,952	6,509	Dredge L, Twin Lakes
Snettisham	Chinook	616	222			286	1,124	
	Coho	5					5	
	Chum	33,016				2,371	35,387	
Tahini River	Chinook	4	1				5	
Twin Lakes	Chinook		5,000				5,000	
Southeast Totals:		752,278	19,958	260	5,000	310,392	1,087,888	
STATE TOTALS:		6,443,369	253,736	8,860	33,390	2,505,320	9,244,675	

BY SPECIES:				
	Chinook	68,419	Steelhead	290
	Coho	256,283	Rainbow	127,400
	Chum	301,825	Grayling	1,300
	Sockeye	5,760,597	A Char	3,600
	Pink	2,724,961		
		9,112,085		132,590

Footnote: Estimates are based upon a varying combination of historical data, standard survival assumptions, fish ticket and coded-wire tag data

Table 3.1B. Estimated commercial contribution of fish by FRED hatcheries and projects in 1991.

Hatchery or Project	Species	Seine	Set Gillnet	Drift Gillnet	Troll	Total	
ARCTIC-YUKON-KUSKOKWIM							
Sikusuilaq	Chum		20,000			20,000	
AYK TOTALS:		0	20,000	0	0	20,000	
COOK INLET							
Big Lake							
Big Lake	Sockeye		29,650	29,650		59,300	
	Coho		325	975		1,300	
Crooked Creek							
Tustumena Lake	Sockeye					125,000	*
Leisure Lake	Sockeye	117,000				117,000	
Chenik Lake	Sockeye	60,000				60,000	
Port Dick Lake	Sockeye	4,600				4,600	
Kirschner Lake	Sockeye	43,000				43,000	
Elmendorf							
Halibut Cove	Chinook	140	280			420	
Seldovia	Chinook		270			270	
Ship Creek	Chinook					130	*
	Coho					410	*
Tutka Bay Lagoon							
Kachemak Bay	Pink	140,000				140,000	
	Chum	1,000				1,000	
Halibut Cove	Pink	60,000				60,000	
COOK INLET TOTALS:		425,740	30,525	30,625	0	612,430	**
KODIAK/ALASKA PENINSULA							
Kitoi Bay	Pink	1,390,700				1,390,700	
	Chum	31,700				31,700	
	Coho	9,800				9,800	
Karluk	Sockeye	1,376,000				1,376,000	
Frazer fishpass	Sockeye		1,494,600			1,494,600	

* = unidentified gear groups

** = Sum of gear group totals does not equal total catch because of unidentified gear groups

Table 3.1B. Continued.

Hatchery or Project	Species	Seine	Set Gillnet	Drift Gillnet	Troll	Total
Afognak Fishpasses	Pink	2,200				2,200
(combined)	Sockeye	32				32
Waterfall Fishpass	Pink	6,900				6,900
Russell Creek	Pink	6,900				6,900
KODIAK/AK PEN TOTALS:		2,824,232	1,494,600	0	0	4,318,832
PRINCE WILLIAM SOUND						
Gulkana	Sockeye			122,500		122,500
Main Bay	Sockeye		184,000	296,200		480,200
	Chum		23,311	113,817		137,128
PWS TOTALS:		0	207,311	532,517	0	739,828
SOUTHEAST REGION						
SOUTHERN						
Bakewell	Sockeye	9,243		9,693		18,936
Dog Salmon	Pink	17,500		5,000	2,500	25,000
	Coho	10			50	60
Ketchikan Creek	Pink	148,400		55,650	18,550	222,600
Marx Cr Spwn Ch	Chum	84		79		163
Margaret L	Sockeye	54		27		81
Sunny Creek	Pink	154,000		44,000	22,000	220,000
Beaver Falls Hatchery						
Hugh Smith Lake	Sockeye	5,295		3,036		8,331
McDonald Lake	Sockeye	46,453		23,062		69,515
Deer Mountain Hatchery						
Big Salt Lake	Chinook				24	24
Bold Island	Coho	765		1,254	254	2,273
Craig	Chinook				24	24
Deer Mountain	Chinook			12	175	187
	Coho	621		2,212	921	3,754
Reflection Lake	Coho	42		94	39	175
Thorne Bay	Chinook			1	11	12
Ward Creek	Coho	140		1,016	495	1,651

Table 3.1B. Continued.

Hatchery or Project	Species	Seine	Set Gillnet	Drift Gillnet	Troll	Total	
Klawock Hatchery							
Cable Creek	Coho	181		7	562	750	
Klawock	Coho	14,335		143	37,771	52,249	
Tunga Lake	Coho	1,817		29	4,564	6,410	
CENTRAL							
Irish Creek	Coho	8,600			25,500	34,100	
Crystal Lake Hatchery							
Crystal Lake	Chinook	6		1,214	9,180	10,400	
	Coho	430		1,000	1,500	2,930	
Earl West Cove	Chinook	1,700		8,700	3,200	13,600	
Ohmer Creek	Chinook	5		28	57	90	
Farragut	Chinook				17	17	
Harding River	Chinook				45	45	
Slippery Creek	Coho	190			300	490	
St. John's Creek	Coho	1		14	12	27	
NORTHERN							
Chilkat Ponds	Coho			500	500	1,000	
Eliza Lake	Chinook			13		13	
Jerry Myers	Chinook	3		9	16	28	
Jerry Myers	Coho				404	404	
Snettisham							
Doty Cove	Chum			6,733		6,733	
Limestone Inlet	Chum			13,613		13,613	
Indian Lake	Coho	22				22	
Indian River	Chinook				8	8	
Juneau/DJ	Chinook	19		352	439	810	
	Coho	125		869	1,118	2,112	
Snettisham	Chinook	46		174	396	616	
	Coho	5				5	
	Chum			33,016		33,016	
Tahini River	Chinook				4	4	
Southeast Totals:		410,092	0	211,550	130,636	752,278	
STATE TOTALS:		3,660,064	1,752,436	774,692	130,636	6,443,368	**

** = Sum of gear group totals does not equal total catch because of unidentified gear groups

Table 3.2. Number of fish released during 1991 by FRED facilities.

Facility	Broodyear	Stock	Species	Released	Avg wt (gm)
ARCTIC/YUKON/KUSKOKWIM					
CLEAR	86	ALEK/DOMESTIC	A CHAR	36	2,134.0
	89	ALEK/DOMESTIC	A CHAR	3,580	720.0
	90	ALEK/DOMESTIC	A CHAR	477,000	29.5
	91	DOMESTIC	GRAYLING	421,000	0.1
	86	MOOSE L	GRAYLING	25	252.0
	87	MOOSE L	GRAYLING	1,300	117.0
	91	MOOSE L	GRAYLING	1,300,000	3.7
	90	PAXSON L	L TROUT	52,900	4.2
SIKUSUILAQ	90	NOATAK R	CHUM	7,365,000	0.4
		ARCTIC/YUKON/KUSKOKWIM:		9,620,841	
COOK INLET					
BIG LAKE	89	BIG LAKE	COHO	224,000	25.2
	90	BIG LAKE	COHO	235,000	1.0
	90	ENGLISH BAY	SOCKEYE	255,000	0.2
	90	MEADOW CR	SOCKEYE	10,037,000	0.2
CROOKED CREEK	89	KASILOF R	CHINOOK	273,500	26.0
	89	CROOKED CREEK	COHO	72,000	24.1
	90	CROOKED CREEK	COHO	322,000	2.0
	90	TUSTUMENA L	SOCKEYE	12,650,000	0.2
	89	CROOKED CR	STEELHEAD	69,000	70.0
	90	CROOKED CR	STEELHEAD	45,000	14.0
ELMENDORF	90	CROOKED CR	CHINOOK	850,000	19.5
	90	SHIP CR	CHINOOK	313,000	17.1
	89	BEAR L	COHO	165,000	22.0
	90	BEAR L	COHO	366,000	7.8
	89	SHIP CREEK	COHO	57,800	23.8
FT RICHARDSON	90	NINILCHIK R	CHINOOK	88,000	12.0
	90	WILLOW CR	CHINOOK	444,000	81.1
	89	LITTLE SUSITNA	COHO	278,000	22.8
	89	CASWELL CR	COHO	156,000	18.5
	87	BIG L/SWANSON	RAINBOW	22	816.0

Table 3.2. Continued.

Facility	Broodyear	Stock	Species	Released	Avg wt (gm)
FT RICHARDSON	88	BIG L/SWANSON	RAINBOW	4,600	905.0
	89	BIG L/SWANSON	RAINBOW	3,000	236.1
	90	BIG L/SWANSON	RAINBOW	265,000	89.1
	91	BIG L/SWANSON	RAINBOW	4,639,000	4.5
TUTKA BAY	90	TUTKA BAY	PINK	30,000,000	0.2
		COOK INLET:		61,811,922	
KODIAK & AK PENINSULA					
KITOI BAY	90	LITTLE KITOI L	COHO	525,000	1.2
	90	KITOI BAY	PINK	124,148,000	0.4
	90	UPPER STATION L	SOCKEYE	1,250,000	2.5
PILLAR CREEK	90	UPPER STATION L	SOCKEYE	3,314,000	0.2
RUSSELL CREEK	90	RUSSELL CR	CHUM	4,900,000	1.1
	90	RUSSELL CR	PINK	3,500,000	0.3
		KODIAK & AK PENINSULA:		137,637,000	
PRINCE WILLIAM SOUND					
GULKANA I	90	GULKANA R	SOCKEYE	21,749,000	0.2
GULKANA II	90	E FK GULKANA R	CHINOOK	26,000	0.7
	90	GULKANA R	SOCKEYE	765,000	0.2
MAIN BAY	90	COGHILL L	SOCKEYE	1,961,000	9.9
	90	ESHAMY L	SOCKEYE	1,718,000	7.4
	90	EYAK L	SOCKEYE	47,600	2.8
		PRINCE WILLIAM SOUND:		26,266,600	
SOUTHEAST					
CRYSTAL LAKE	89	CRYSTAL CR	CHINOOK	837,000	15.8
	89	CRYSTAL CR	COHO	78,800	14.0
	90	CRYSTAL CR	COHO	412,000	0.5
	89	CRYSTAL CR	STEELHEAD	2,180	66.5

Table 3.2. Continued.

Facility	Broodyear, Stock	Species	Released	Avg wt (gm)
DEER MOUNTAIN	89 KETCHIKAN CR	CHINOOK	154,000	21.1
	89 REFLECTION L	COHO	66,200	17.1
	90 REFLECTION L	COHO	50,900	12.4
	91 FT RICHARDSON	RAINBOW	5,480	4.5
	89 KETCHIKAN CR	STEELHEAD	5,020	45.7
KLAWOCK	90 CABLE CREEK	COHO	80,400	8.2
	89 KLAWOCK R	COHO	1,310,000	25.2
	90 KLAWOCK L	SOCKEYE	197,000	25.2
	89 KLAWOCK R	STEELHEAD	4,560	213.5
	90 KLAWOCK R	STEELHEAD	25,700	45.6
SNETTISHAM	88 CRYSTAL CR	CHINOOK	307,000	20.0
	89 SNETTISHAM	CHINOOK	91,200	25.9
	90 SNETTISHAM	CHUM	2,357,000	0.6
	89 SNETTISHAM	COHO	220,000	0.6
	90 CRESCENT L	SOCKEYE	458,000	0.2
	90 SPEEL L	SOCKEYE	1,310,000	0.2
	90 TAHLTAN L	SOCKEYE	3,585,000	0.1
	90 TATSAMENIE L	SOCKEYE	673,000	0.2
	90 TRAPPER L	SOCKEYE	934,000	0.2
	SOUTHEAST:		13,164,440	

Species total:

CHINOOK	3,383,700	RAINBOW	4,917,102
COHO	4,619,100	STEELHEAD	151,460
CHUM	14,622,000	A CHAR	480,616
SOCKEYE	60,903,600	L TROUT	52,900
PINK	157,648,000	GRAYLING	1,722,325
			248,500,803

Table 3.3. Estimated number of eggs taken by FRED Division during 1991

Facility	Broodstock	Species	Eggs Taken
ARCTIC/YUKON/KUSKOKWIM			
CLEAR	ALEK/DOMESTIC	A CHAR	2,047,000
	MOOSE L	GRAYLING	2,834,000
SIKUSUILAQ	NOATAK R	CHUM	10,813,400
NOME INCUBATORS	HOBSON CR	CHUM	20,000
	BOULDER CR	PINK	8,000
	HOBSON CR	PINK	22,000
	ARCTIC/YUKON/KUSKOKWIM		15,744,400
COOK INLET			
BIG LAKE	BIG LAKE	COHO	749,000
	ENGLISH BAY	SOCKEYE	512,000
	MEADOW CR	SOCKEYE	8,000,000
CROOKED CREEK	KASILOF R	CHINOOK	337,500
	CROOKED CREEK	COHO	484,000
	TUSTUMENA L	SOCKEYE	17,200,000
	CROOKED CR	STEELHEAD	50,000
ELMENDORF	CROOKED CR	CHINOOK	1,152,000
	SHIP CR	CHINOOK	309,000
	BEAR L	COHO	864,000
	SHIP CREEK	COHO	100,000
FT RICHARDSON	NINILCHIK R	CHINOOK	252,000
	WILLOW CR	CHINOOK	430,000
	LITTLE SUSITNA	COHO	754,000
	SWANSON/BIG LAKE	RAINBOW	6,732,000
	COOK INLET		37,925,500
KODIAK & AK PENINSULA			
KITOI BAY	KITOI BAY	CHUM	25,200,000
	KITOI BAY	PINK	170,000,000
	UPPER STATION L	SOCKEYE	2,300,000
	LITTLE KITOI L	COHO	1,000,000

Table 3.3. Continued.

Facility	Broodstock	Species	Eggs Taken
PILLAR CREEK	UPPER STATION L	SOCKEYE	3,900,000
	AFOGNAK L	SOCKEYE	2,500,000
	MALINA L	SOCKEYE	145,000
	MONASHKA CR	COHO	60,000
RUSSELL CREEK	RUSSELL CR	CHUM	12,600,000
	RUSSELL CR	PINK	8,000,000
	MORTENSEN CR	SOCKEYE	1,000,000
	MORTENSEN CR	COHO	300,000
	KODIAK & AK PENINSULA		227,005,000
PRINCE WILLIAM SOUND			
GULKANA I	GULKANA R	SOCKEYE	36,052,000
GULKANA II	E FK GULKANA R	CHINOOK	92,000
	GULKANA R	SOCKEYE	1,282,000
	PRINCE WILLIAM SOUND		37,426,000
SOUTHEAST			
CRYSTAL LAKE	CRYSTAL CR	CHINOOK	1,701,000
	FARRAGUT R	CHINOOK	109,000
	HARDING R	CHINOOK	58,000
	CRYSTAL CR	COHO	360,000
	CRYSTAL CR	STEELHEAD	13,000
	FALLS CR	STEELHEAD	6,000
DEER MOUNTAIN	KETCHIKAN CR	CHINOOK	305,000
	REFLECTION L	COHO	130,000
	WARD L	COHO	82,000
	KETCHIKAN CR	STEELHEAD	14,600
KLAWOCK	CABLE CR	COHO	67,000
	KLAWOCK	COHO	386,000
	RIO ROBERTS	COHO	65,000
	KLAWOCK L	SOCKEYE	2,058,000
	KLAWOCK L	STEELHEAD	101,000

Table 3.3. Continued.

Facility	Broodstock	Species	Eggs Taken
SNETTISHAM	CRYSTAL L	CHINOOK	2,139,000
	LPW (UNUK R)	CHINOOK	1,225,000
	SNETTISHAM	CHINOOK	486,000
	SNETT/KSR	CHINOOK	13,000
	CRESCENT L	SOCKEYE	1,007,000
	TAHLTAN L	SOCKEYE	4,753,000
	TATSAMENIE L	SOCKEYE	1,396,000
	TRAPPER L	SOCKEYE	3,108,000
	SOUTHEAST		19,582,600

TOTAL	CHINOOK	8,608,500	RAINBOW	6,732,000
SPECIES	COHO	5,401,000	STEELHEAD	184,600
	CHUM	48,633,400	A CHAR	2,047,000
	SOCKEYE	85,213,000	L TROUT	0
	PINK	178,030,000	GRAYLING	2,834,000
				337,683,500

increase in chinook salmon eggs and a slight decrease in sockeye salmon eggs. Sockeye and coho salmon egg numbers essentially changed places at Klawock Hatchery between 1990 and 1991. Sockeye salmon eggs taken at Klawock tripled in 1991, and the crew took only one-third of the 1990 number of coho salmon eggs. This reflects the changing mission of this facility to include major rehabilitation of the sockeye salmon runs in Klawock Lake. Most egg-collection goals were met at Deer Mountain and Klawock Hatcheries in 1991. Although the numerical goal (10 million) for Klawock sockeye salmon eggs, as stated in the hatchery annual management plan, was not met, the hatchery was successful in taking a large percentage of the available eggs (2 million).

CHAPTER 4

PRINCE WILLIAM SOUND

Summary of FRED Projects

The Prince William Sound area encompasses Commercial Fisheries Management Area E and includes the marine waters and freshwater drainages between Cape Suckling and Cape Fairfield (Figure 4.1). The three distinct geographic subareas present include: (1) Prince William Sound drainages and estuary; (2) the Copper River drainage and estuary; and (3) the Bering River drainage and estuary.

The **commercial fishery** includes three gear groups: Purse seine, drift gill net, and set gill net. The catch is composed primarily of sockeye, pink, and chum salmon.

Substantial **subsistence and personal-use** fisheries occur in the upper Copper River where sockeye salmon are harvested along with lesser numbers of chinook and coho salmon. Some subsistence fishing does occur on the Copper River Delta and in Prince William Sound, but catches are not considered significant.

Extensive **sport fisheries** exist on the upper Copper River, Valdez Bay (Valdez), Passage Canal (Whittier), and Orca Inlet/Copper River Delta (Cordova). The upper Copper River fishery is aimed primarily at native chinook and sockeye salmon. The Valdez Bay fishery harvests pink and coho salmon. The Passage Canal fishery is aimed primarily at hatchery-produced coho and chinook salmon. The Orca Inlet/Copper River Delta fishery is directed toward coho and sockeye salmon.

FRED Division activities in Prince William Sound during 1991 were heavily influenced by continuing repercussions from the **Exxon Valdez oil spill**. Prince William Sound area staff were involved in several oil spill damage assessment and restoration projects. Natural Resource Damage Assessment (NRDA) Study Number 3 involved coded-wire tagging over 2 million hatchery and wild salmon. Recovery of these tagged fish will be used to estimate survival from oiled and non-oiled sites. NRDA Study Number 4 involved the capture of over 1 million juvenile salmon, including 1,200 coded-wire-tagged fish. The results from this study are used to estimate the growth and survival of juvenile salmon during their early marine life. Restoration Implementation Study Number 3's focus is on determining the best methods to restore damaged spawning habitats.

FRED Division staff continue **limnological studies** on several lakes in the Prince William Sound area. Area personnel are involved in two cooperative projects with the USFS. The first is an experimental stocking and lake-fertilization study of 2 barren lakes. The results from this study have been used to document the success of sockeye salmon presmolt (fall period) introductions for use in other Alaskan lakes. The second cooperative project is focused on rehabilitating depressed sockeye salmon runs to Coghill Lake. Lake fertilization and continued monitoring are planned for the 1992 season.

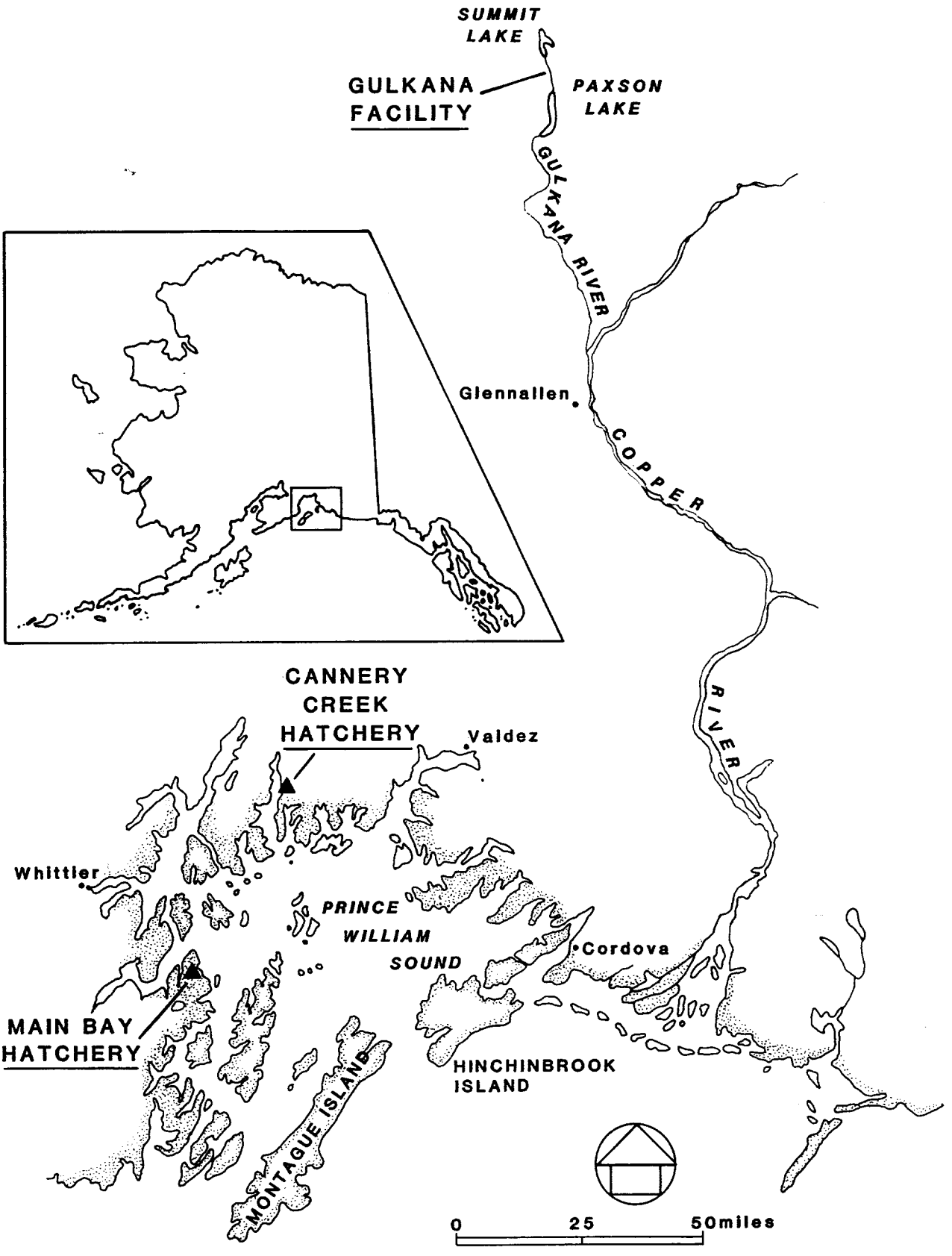


Figure 4.1. Map of Prince William Sound.

The **Main Bay Hatchery** is the only hatchery in Alaska that raises yearling[1] sockeye salmon smolts. The Prince William Sound Aquaculture Corporation (PWSAC) took over operation of the Main Bay Hatchery on 1 July 1991. The FRED Division continues to operate the **Gulkana Incubation Facility** with funds provided by PWSAC. This relationship is expected to continue for several years until PWSAC personnel become more familiar with operation of the hatchery. FRED Division area, regional, and headquarters personnel have spent a great deal of time and energy to assure a successful transition at both hatcheries.

The **Gulkana I** streamside sockeye salmon incubation facility, located on the East Fork of the Gulkana River, continued its status as the largest hatchery producer of sockeye salmon fry in Alaska in 1991. Sockeye salmon fry from Gulkana I were released at 3 sites in 1991 to produce fish for commercial, subsistence, personal-use, and sport fisheries. In addition to releasing fry, limnological and/or hydroacoustical sampling of Paxson, Summit, and Crosswind Lakes has been continued to assess the biological effects of the FRED Division's enhancement efforts. Disease samples were collected for the FRED Division Fish Pathology Section to monitor prevalence of IHN virus and other pathogens in brood stock populations, or when losses occurred. The **Gulkana II** facility continues to incubate sockeye and chinook salmon fry to build brood stock levels for future use. Chinook salmon fry are stocked in Monsoon and Dickie Lakes as part of an experimental barren lake-stocking program.

Enhancement of the **sport fisheries** in drainages of Prince William Sound and the Copper River Basin continues to be a high priority for the FRED Division. A large rainbow trout sport fisheries enhancement program from the Fort Richardson Hatchery was continued in 1991. This program involves planting both catchable and fingerling rainbow trout in accessible lakes along the Richardson and Glenn Highways. A similar program with Arctic grayling is conducted from the FRED Division's Clear Hatchery. In addition to releasing emergent fry in lakes along the Richardson and Glenn Highways, several lakes accessible from the Copper River Highway were also stocked.

The Prince William Sound area has the largest concentration of **commercial fisheries**-oriented hatcheries in Alaska. This large amount of hatchery production has resulted in a user-group conflict centered on **allocation** of fish. In 1989 PWSAC was directed by the Alaska Board of Fisheries to develop an allocation plan for all hatchery-produced fish in Area E. FRED Division staff spent a great deal of time assisting an Allocation Task Force with the development of an allocation policy for PWSAC. These efforts resulted in a Prince William Sound management/allocation plan that was presented to the Alaska Board of Fisheries in 1991. As chairman of the Prince William Sound/Copper River Regional Planning Team (PWS/CR RPT), the FRED Division area biologist continued to be involved in allocation issues as well as development of regional comprehensive salmon enhancement plans.

Prince William Sound Highlights

- An estimated 485,000 hatchery-produced sockeye salmon adults returned to Main Bay Hatchery; of these, approximately 480,000 were caught in the commercial fishery.

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[1] Reared in hatchery raceways for 12 months.

- Main Bay Hatchery personnel released a record 3.7 million sockeye salmon smolts at the hatchery and at Eshamy and Coghill Lakes.

- An estimated 137,000 chum salmon from previous FRED Division releases were harvested by the commercial fishing fleet at Main Bay Hatchery.

- The 1991 Gulkana I sockeye salmon egg take of 36.05 million eggs became the largest sockeye salmon egg take in the world.

- The FRED Division directed the tagging of over 2 million salmon fry or smolts as part of an oil spill impact assessment study.

- FRED Division area staff continued early marine studies on juvenile salmon to assess impacts of the *Exxon Valdez* oil spill. Study results will also be useful for evaluating interactions between hatchery and wild-stock juvenile salmon.

- FRED Division area staff initiated a survey of damaged salmon-spawning habitats in Prince William Sound. Survey results will be used to determine the best means for habitat restoration.

Prince William Sound Returns and Fishery Contributions

In 1991 an estimated 137,000 chum salmon returned to Prince William Sound from releases at Main Bay Hatchery. All of these chum salmon were harvested in the commercial fishery. In addition to chum salmon, the Main Bay Hatchery experienced its largest adult return of sockeye salmon when an estimated 485,000 adults returned to the hatchery; of these, 480,000 were harvested.

An estimated 122,500 sockeye salmon from the Gulkana Hatchery, worth approximately $2 million, were harvested in the commercial fishery. These fish resulted from fry releases in 1986 and 1987. Significant contributions to the subsistence and personal-use fisheries also occurred, and carcasses from the Gulkana egg take were donated to area dog mushers for dog food.

Prince William Sound Releases

The Main Bay Hatchery released over 3.6 million sockeye salmon smolts in 1991. Three groups of fish were released at different sizes to determine the effect of size-at-release on marine survival. The results from this study will be useful to PWSAC staff as they further refine the sockeye salmon program at Main Bay.

Gulkana I released over 21.7 million sockeye salmon fry in 1991 into 3 different locations. Large numbers of fish were also released to enhance Prince William Sound sport fisheries. These releases included planting a total of 60,000 Arctic grayling fry and fingerlings from Clear Hatchery into 6 road-accessible lakes in the area, and releasing 252,000 rainbow trout fingerlings and fry from Fort Richardson Hatchery into 29 road-accessible area lakes.

Prince William Sound Egg Takes

Prince William Sound egg takes at the Main Bay Hatchery were conducted by PWSAC after 1 July 1991. At Gulkana I, the egg-take crew set a new season record when they collected 36,052,000 sockeye salmon eggs. Not only were many eggs taken, but by following special sockeye salmon egg-take procedures and special handling, IHN virus outbreaks were controlled and minimized with a limited loss of fry during the 1991 season. Gulkana II egg takes for sockeye and chinook salmon were conducted for the third season with 1,282,000 and 92,200 eggs taken, respectively.

CHAPTER 5

COOK INLET

Summary of FRED Projects

The drainages of Cook Inlet comprise only a small portion of the entire state, but the population of this area includes half of Alaska's people. Consequently, numerous FRED Division projects and 6 FRED Division facilities are located in the Cook Inlet area (Figure 5.1). Big Lake Hatchery, in the Susitna Valley, produces coho and sockeye salmon; Elmendorf and Fort Richardson Hatcheries produce fish for sport fisheries enhancement projects throughout the Southcentral Region and other parts of the state; the Broodstock Development Center (BDC) provides rainbow trout eggs for the statewide stocking program; Crooked Creek Hatchery primarily produces sockeye salmon for commercial fisheries, and chinook and coho salmon and steelhead trout for sport fisheries; and Tutka Bay Hatchery (transferred to the Cook Inlet Aquaculture Association [CIAA] in July 1991) on the south end of the Kenai Peninsula, primarily produces pink salmon that are harvested by commercial and sport fishermen. Area biologists, located at Big Lake, Soldotna, and Homer, provide technical support for these projects and maintain coordination with biologists from the fisheries management divisions.

Upper Cook Inlet:

Big Lake Hatchery was built in 1976 as a 16 million-egg sockeye salmon incubation facility to supplement poor adult returns to upper Cook Inlet. Big Lake Hatchery production is now set at 13 million sockeye salmon fry for the Big Lake drainage, 250,000 coho salmon smolts for Knik Arm tributaries, and 330,000 coho salmon fingerlings for planting in interior Alaska lakes.

Big Lake Hatchery has been releasing salmon fry in the northern Cook Inlet area since 1977. Initially, unfed sockeye and coho salmon fry were released in area lakes. As rearing facilities were added, the hatchery began to short-term-rear all fish prior to release. In recent years, all coho salmon smolt production has shifted from release of fed fry to release of smolts.

The **Elmendorf State Hatchery** produces chinook and coho salmon smolts to enhance sport fishing opportunities at sites throughout southcentral Alaska and Kodiak. The hatchery is located two miles north of downtown Anchorage, next to the power plant for the Elmendorf Air Force Base. Through an agreement with the U.S. Air Force, the hatchery uses the excess heated-water effluent from the power plant to accelerate growth and development of some fish stocks. The hatchery produces accelerated-growth age-zero (subyearling) chinook salmon smolts, age-one and age-zero coho salmon smolts, and coho salmon fingerlings.

Elmendorf Hatchery is a centralized incubation and rearing facility. Its programs serve Kachemak Bay, Resurrection Bay, central Cook Inlet, the Matanuska Valley, Anchorage, and Kodiak. A coho salmon rearing-density experiment was initiated in 1991. Two groups of

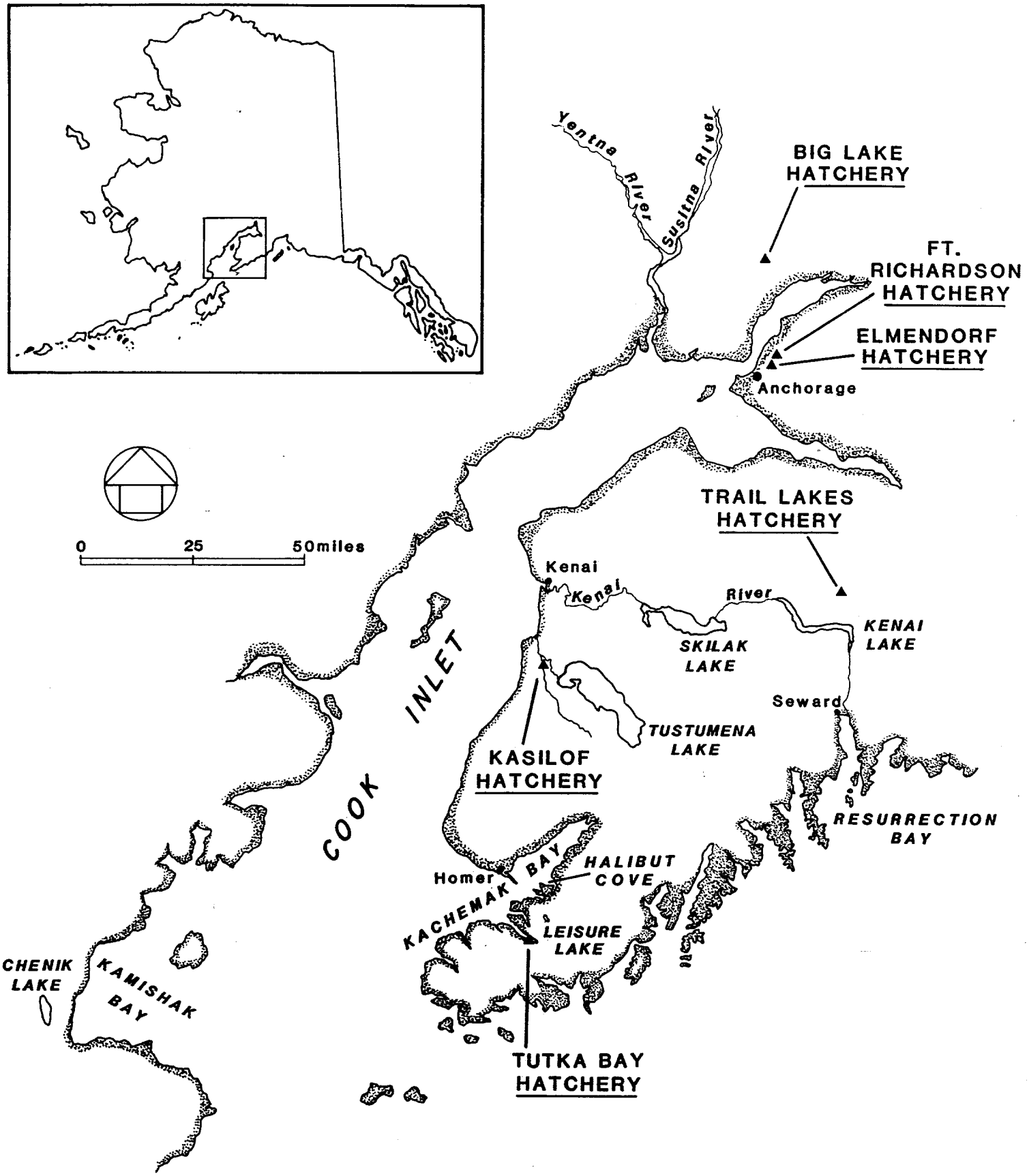

Figure 5.1. Map of Cook Inlet.

coho salmon smolts were reared at two different densities and differentially coded-wire-tagged. Both groups performed well in the hatchery and were released at Homer Spit.

The objective of the **BDC** is to develop and maintain brood stock for rainbow trout enhancement programs in southcentral and interior Alaska. In addition, the BDC was also designed as a small research facility to solve problems encountered in the production of rainbow trout and other species. To accomplish these goals, the BDC was established as a part of the Fort Richardson Hatchery.

The three primary projects of brood stock maintenance, random-lot spawning, and development of an all-female brood stock are the core of the BDC program. These satisfy the facility's primary objective.

Production of all-female rainbow trout, production of triploid rainbow trout, a test of the efficacy of three sperm activators relative to water, and determining the transfer efficiency of oxygen in contactors of various heights, were research projects supported by the BDC in 1991. The BDC also cooperated with the University of Alaska-Fairbanks (UAF) in an electroshocking study and with the National Marine Fisheries Service (NMFS) in a mass-marking study through staff assistance and physical plant services. The goal of the random lot-spawning project at the BDC is to operate the annual rainbow trout egg take and collect enough eggs for southcentral and interior Alaska rainbow trout sport fisheries enhancement programs and replacement brood stock. Fish spawned randomly within each of the 3 strains produced 6.9 million green eggs during 12 days of egg takes in 1991. The fertilization rate (93.4%) exceeded all expectations, and the survival rate to the eyed-egg stage (<90%) set a new record.

Another project at the BDC is designed to manipulate the sex of the brood stock to improve the efficiency of rainbow trout production and improve angling opportunities. Progeny from experimental groups of all-female fish were sampled to determine sex ratios which would help identify the genetic makeup of the male parent. Progeny from 4 groups were fed testosterone-treated food from emergence to create males for future production. It appears that this project will lead to reduced costs for brood stock maintenance, and an experimental release has been made to evaluate their growth and survival and contribution to the sport fish enhancement program.

The **Fort Richardson Hatchery** is a state facility operated by the FRED Division and located on the Fort Richardson Military Reservation near Anchorage. This complex CIF is designed and operated for the production of rainbow trout and chinook and coho salmon for planting in numerous streams, lakes, and marine waters to create or enhance a wide variety of sport fisheries. The most important program is the production of rainbow trout. The hatchery is designed to use only well water for fish production, and heat is extracted from the U.S. Army's Central Heat and Power Plant effluent through a heat-exchanger system to warm the well water and accelerate fish growth. Current maximum production at Fort Richardson Hatchery, limited by the availability of well water, is approximately 5 million fish, or 55,000 kg, annually. Typically, this will include 2.0-2.5 million rainbow trout fingerlings, 200,000-250,000 catchable-sized rainbow trout, 800,000 chinook salmon smolts, and 600,000 coho salmon smolts.

All fish produced at Fort Richardson Hatchery (rainbow trout, coho salmon, and chinook salmon) are targeted for sport fisheries. Fish are released throughout interior and southcentral Alaska. Approximately 200 lakes, streams, and estuaries receive fish from Fort Richardson Hatchery requiring nearly 20,000 miles of transport-related travel. Rainbow trout production has three components: (1) Fingerlings are released in numerous lakes in southcentral and interior Alaska, (2) small subcatchables are released in the Fairbanks area, and (3) large subcatchables are released in Anchorage, Palmer, Glennallen, and Fairbanks area lakes. Coho salmon smolts are released in upper Cook Inlet streams and Prince William Sound, and chinook salmon smolts are released at Willow Creek and the Ninilchik River on the Kenai Peninsula. Nearly 450,000 coho salmon smolts were released as full-term smolts in 1991 at Nancy Lake, Caswell Creek, and Fleming Spit.

Fort Richardson Hatchery also continued to produce large, post-smolt chinook salmon for the Anchorage urban lakes winter fishery. Smolts were held from late May, the normal release time, until late October as post-smolts. Smolts were also released into Willow Creek and Ninilchik River.

***Central Cook Inlet*:**

Two hatcheries are located in central Cook Inlet. One located near Kasilof (Crooked Creek Hatchery) is operated by the state, and the other near Moose Pass (Trail Lakes Hatchery), has been operated by CIAA under a 20-year state contract since 1988.

The **Crooked Creek Hatchery** has an egg capacity of approximately 20 million sockeye salmon eggs, and produces fingerlings for stocking programs at Tustumena Lake and 8 lakes in lower Cook Inlet. In 1989 the Crooked Creek Hatchery expanded production by taking over a portion of the coho salmon sport fish enhancement program that was previously accomplished at the Trail Lakes Hatchery. The moist-air incubation procedure, first used for coho salmon eggs in 1989, is also being used for Kasilof River chinook salmon eggs to accelerate development. Coho salmon fingerlings, age-one coho salmon smolts, and age-one chinook salmon smolts are produced each year. Crooked Creek Hatchery also produces age-one steelhead trout smolts for release into Crooked Creek.

***Lower Cook Inlet*:**

The **Tutka Bay Hatchery** is a remote hatchery located near the southwest tip of the Kenai Peninsula in southcentral Alaska, approximately 15 air miles across Kachemak Bay from Homer. The hatchery consists of a one-story structure that includes a pink and chum salmon-incubation area, sockeye salmon module, office, laboratory, shop, and emergency-generator room. There are also two single-family dwellings and a bunkhouse. In addition, an egg take and short-term-rearing complex is located in Tutka Lagoon, approximately three-quarters-of-a-mile distance from the hatchery. The hatchery was constructed in 1976 with a designed capacity of 10 million eggs, but is now capable of incubating up to 50 million eggs and rear up to 25 million. In July 1991, the operation of Tutka Bay Hatchery was contracted to CIAA.

The **English Bay Lakes** system has the only significant natural run of sockeye salmon in the Southern District of the lower Cook Inlet area. An enhancement project was initiated here in 1989 to reverse declining trends in the English Bay sockeye salmon escapements and harvests

in the English Bay Lakes system. Approximately 355,000 sockeye salmon fry were released into English Bay Lakes in 1990 from Tutka Bay Hatchery, and over 255,000 fry were released in 1991 from Big Lake Hatchery. The major goal of this rehabilitation and enhancement project is to restore the depleted English Bay sockeye salmon fisheries for harvest by subsistence, commercial, and sport fishing user groups in the English Bay-Port Graham area. This is a cooperative project between the Village of English Bay, The North Pacific Rim Corporation, the Bureau of Indian Affairs, and the FRED Division. Local villagers have been hired for on-the-job training in fisheries enhancement techniques. Over 500,000 sockeye salmon eggs were collected from the 1991 brood stock for incubation at Big Lake Hatchery. The fry from these eggs will be transported back to the English Bay Lake system next spring.

The FRED Division also maintains an area office in Homer on the lower Kenai Peninsula. The lower Cook Inlet management area includes the waters west of Cape Fairfield, north of Cape Douglas, and south of Anchor Point. Fisheries enhancement has played a major role in salmon production for the various user groups in the lower Cook Inlet area in recent years. Since 1988 enhancement projects contributed 52%-71% of the entire lower Cook Inlet commercial salmon harvest and ex-vessel value. In 1991 pink salmon from enhancement projects made up 25% of the catch. Sockeye salmon (67% enhancement production) made up the next highest harvest, followed by chum, coho, and chinook salmon. Ex-vessel value of the 1991 salmon harvest for all species was $1.4 million.

Cook Inlet Highlights

- Big Lake Hatchery released 255,000 sockeye salmon fry in English Bay Lakes and carried out smolt, adult, and lake limnological studies as part of a cooperative program with The North Pacific Rim Corporation and Village of English Bay.

- Big Lake Hatchery successfully applied experimental results to use small, outdoor raceways all winter long without icing problems to rear coho salmon smolts.

- In 1990 over 65% of the sport fish harvested in the Fairbanks area were of hatchery origin (preliminary information indicates that this has increased to approximately 75% in 1991).

- Over 10,000 angler days were spent harvesting 8,558 rainbow trout that originated from Fort Richardson Hatchery at Chena Lake near Fairbanks in 1990 (1991 data not yet available).

- Over 89,000 angler days were generated by Fort Richardson Hatchery's rainbow trout projects in Anchorage area lakes in 1990, and over 11,000 angler days were spent harvesting 10,223 rainbow trout in the Kepler Lakes complex near Palmer in 1990 (1991 data not yet available).

- The first production-sized lots of "all-female" and "all-female-triploid" rainbow trout were produced at the BDC.

- The fertility rate for rainbow trout eggs was increased significantly after water was replaced with a saline solution to activate the sperm. This was an application of experimental results at the BDC.

- An estimated total of 4,740 hatchery-produced coho salmon returned to Crooked Creek in 1991. Of these, an estimated 1,655 were caught in the sport fishery.

- The 1991 total return to the Leisure Lake sockeye salmon stocking and fertilization project was estimated at 101,000 sockeye salmon. The commercial harvest of 96,000 fish comprised 29% of the lower Cook Inlet sockeye salmon harvest. Personal-use dipnet fishermen and sport fishermen harvested another 5,000 sockeye salmon.

- The commercial harvest of 200,000 pink salmon from Tutka Bay and Lagoon and from the Halibut Cove Lagoon remote rearing and release site accounted for 84% of the Southern District and 25% of the entire lower Cook Inlet commercial pink salmon harvest. Because of the weak return to the Tutka Bay Hatchery, the sport harvest in Tutka Lagoon was estimated at only 2,000 pink salmon.

- Over 14,000 salmon returned to the Homer Spit sport fish enhancement project in 1991, representing the highest catch to date. Sport fishermen harvested approximately 3,500 chinook salmon from late May to early July, 500 pink salmon during July through early August, and 10,000 adult coho salmon from August and into October. In addition, approximately 800 coho salmon (13%) were intercepted in the personal-use gillnet fishery.

- The first returns to Ninilchik River of chinook salmon from the initial smolt release from Fort Richardson Hatchery occurred in 1991. Data collected during the creel survey were used in-season by the Sport Fish Division area biologist to extend the sport fishery by emergency order for an additional 10 days. Returns from the hatchery chinook salmon smolt releases accounted for 1,924 fish, 39% of the 1991 harvest.

- The commercial harvest of Chenik Lake sockeye salmon (Crooked Creek Hatchery) totaled 60,400 fish, 18% of the entire lower Cook Inlet sockeye salmon harvest.

- Sockeye salmon returns to all lower Cook Inlet enhancement sites contributed nearly 70% to the entire lower Cook Inlet commercial harvest for that species in 1991.

Cook Inlet Returns and Contributions

In-season evaluation is no longer done at many of the hatchery-release sites, so adult returns for the 1991 season cannot be fully assessed.

Sockeye salmon bound for Big Lake were intercepted in area commercial, personal-use, subsistence, and sport fisheries. The personal-use dipnet fishery at the mouth of Fish Creek is very popular among roadside residents. This fishery was open for 11 consecutive days in 1991. At times, over 400 people were observed dip netting, and an estimated 5,000 sockeye salmon were sport-harvested.

Sport fisheries harvest data are not available for 1991 chinook or coho salmon returns from Elmendorf Hatchery releases at Resurrection Bay, Ship Creek, or Crooked Creek, and there are not yet significant adult returns from the new chinook salmon release sites at Eagle River or Kodiak, as these two programs were just recently started. The 1990 estimated sport fish harvests from Elmendorf Hatchery smolt releases (post-season harvest survey) were 1,004 chinook salmon and 8,721 coho salmon at Resurrection Bay, 445 chinook salmon and 818 coho salmon from Ship Creek, and over 15,000 pan-sized, landlocked salmon from Matanuska Valley lakes. Data for the 1991 sport harvests are expected to be somewhat larger. The Ship Creek chinook salmon sport fishery was opened 7 days per week in 1991 instead of 2 days per week, so the harvest should be substantially higher this year. Altogether, the estimated sport fish harvests of adult salmon from Elmendorf Hatchery smolt releases total approximately 13,000 chinook salmon and 19,000 coho salmon.

The estimated total number of hatchery-produced sockeye salmon that returned in 1991 from the Tustumena Lake enhancement project has not been analyzed; however, in 1990, an estimated 195,000 hatchery-produced sockeye salmon contributed to the total return. There should be a similar number (190,000) for 1991.

There was no creel survey for the Kasilof River chinook salmon sport fishery in 1991, so the actual total return (escapement and harvest) of chinook salmon to Crooked Creek (Crooked Creek Hatchery) is not available. However, based on data from prior years, the total return is estimated to be around 6,100. The total hatchery return of coho salmon is estimated to be 4,740, and of steelhead trout, 290.

FRED Division projects provided 36% (425,620 salmon) of the total 1991 lower Cook Inlet commercial harvest of 1,185,320 fish. The Leisure, Chenik, Hazel, Port Dick, and Kirschner Lakes sockeye salmon enhancement projects produced approximately 67% (224,600) of the total lower Cook Inlet harvest of 332,890 sockeye salmon in 1991. Tutka Bay Hatchery production, along with the FRED Division/Cook Inlet Seiners Association cooperative rearing project at Halibut Cove Lagoon, accounted for 25% (200,000 pink salmon) of the lower Cook Inlet commercial pink salmon harvest of 813,760 fish in 1991.

The contribution of FRED Division-produced salmon was approximately 50% ($0.7 million) of the $1.4 million value of the 1991 lower Cook Inlet commercial salmon harvest.

In 1991 over 29,100 salmon were harvested by sport fishermen from various enhancement projects in the Kachemak Bay area. The Homer Spit sport fish enhancement project provided over 14,000 salmon for shore-based anglers, including 3,500 chinook salmon, 10,000 coho salmon, and 500 pink salmon. Another 2,250 and 1,250 chinook salmon were caught by anglers at Halibut Cove Lagoon and Seldovia, respectively.

Cook Inlet Releases

Big Lake Hatchery released 10 million sockeye salmon fry into Big Lake to augment natural production in the lake.

Over 658,000 coho salmon smolts were planted in the waters of northern Cook Inlet to provide fish to area sport fisheries. An additional 392,000 chinook salmon smolts were released to augment area chinook salmon fishing.

Releases in 1991 from Fort Richardson Hatchery into southcentral and interior Alaska waters to augment the sport fishery included more than 5 million rainbow trout, chinook and coho salmon.

A total of 37.5 million juvenile salmon of four species of Pacific salmon were released in lower Cook Inlet in 1991.

Cook Inlet Egg Takes

Big Lake Hatchery took an estimated 8 million sockeye salmon eggs in 1991.

Northern Cook Inlet crews took over 430,000 chinook salmon eggs and 1.5 million coho salmon eggs to meet the enhancement demand for area sport fisheries.

Approximately 6.7 million rainbow trout eggs were taken from Swanson River, Big Lake, and Swanson River Select strains during 12 days of egg takes at the BDC.

A total of 17.2 million eggs was taken from the sockeye salmon stock at Tustumena Lake to continue hatchery releases of sockeye salmon fingerlings in lakes of lower Cook Inlet as well as Tustumena Lake. Chinook salmon eggs taken by Crooked Creek Hatchery staff included 1,150,000 eggs from the Crooked Creek brood stock that were transferred to the Elmendorf Hatchery for age-zero smolt production, 252,000 eggs from the Ninilchik River brood stock that were transferred to the Fort Richardson Hatchery for age-zero smolt production, and 338,000 eggs from the Kasilof River brood stock for age-one smolt production at Crooked Creek Hatchery. Finally, 484,000 coho salmon eggs and 50,000 steelhead trout eggs were taken from Crooked Creek for incubation and rearing at the Crooked Creek Hatchery.

Over 500,000 sockeye salmon eggs were taken from the English Bay Lakes system for incubation at Big Lake Hatchery.

CHAPTER 6

KODIAK AND ALASKA PENINSULA

Summary of FRED Projects

The FRED Division Kodiak Area Office is located in the City of Kodiak. The area includes the Kodiak Island Archipelago (Figure 6.1) and the south and east slopes of the Alaska Peninsula from Cape Douglas to the southern entrance of Imuya Bay (Figure 6.2). FRED Division fish-production facilities in the Kodiak and Alaska Peninsula areas include Pillar Creek and Kitoi Bay Hatcheries near Kodiak that are operated with funds provided by the Kodiak Regional Aquaculture Association (KRAA), and Russell Creek Hatchery, located near Cold Bay.

The FRED Division operates a number of projects and facilities that contribute salmon to the annual production of the Kodiak area. Projects, such as the Karluk and Frazer Lake fertilization, are designed to rehabilitate areas that were historically productive; others, such as the Kitoi Bay Hatchery, enhance natural production. The salmon produced by the FRED Division benefit commercial, sport, personal-use, and subsistence fisheries.

Lake fertilization, a wild stock-restoration technique, was expanded in 1991 at Frazer, Malina, and Afognak Lakes as an important step in rehabilitating significant runs of sockeye salmon. As with other programs in the Kodiak area, this is a cooperative venture with KRAA; KRAA handles the contract and the FRED Division evaluates the results of the effort.

Pillar Creek Hatchery was constructed in the summer of 1990 under a cooperative agreement between the FRED Division and KRAA. It was designed as a 20 million-egg sockeye salmon incubation facility located on the road system approximately 7 miles from the City of Kodiak. The facility will create new fisheries for Kodiak Island seiners and gillnet fishermen by planting several barren-lake systems with sockeye salmon fry from donor stocks. Depleted natural runs in need of rehabilitation will also be stocked with fry from their native stock.

The largest project at Pillar Creek Hatchery is the planting of late-run sockeye salmon into **Spiridon Lake**. The intent of this project is to create a new fishery for returning adult sockeye salmon by releasing 5 million fry into Spiridon Lake for the first 2 years, 8 million for the following 2 years, and to reach a capacity of 11 million fry. A brood stock for this project is currently being developed at Kitoi Bay Hatchery using Upper Station Lake eggs. Brood fish returning to Kitoi Bay will eliminate the necessity of the remote egg take at Upper Station Lake by 1993.

A rehabilitation project will take place on the **Malina Lake** system with 1.5 million sockeye salmon eggs being taken from the lake and returned to the system. **Jennifer Lake** will receive 300,000 fry from the late-run Upper Station Lake donor stock. This is a barren system located on the southwest side of Afognak Island. A permit to take 100,000 coho

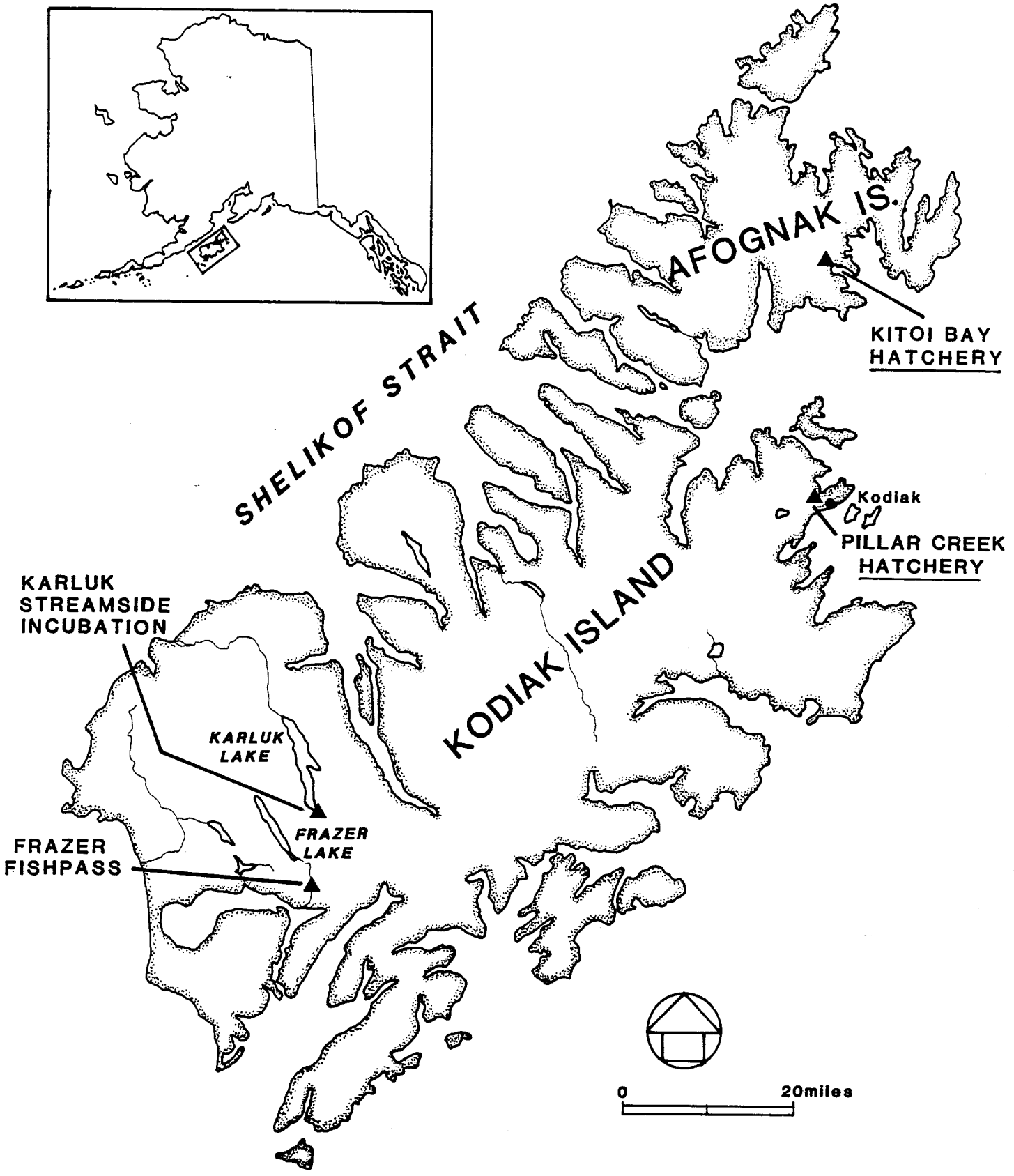

Figure 6.1. Map of Kodiak Island Archipelago.

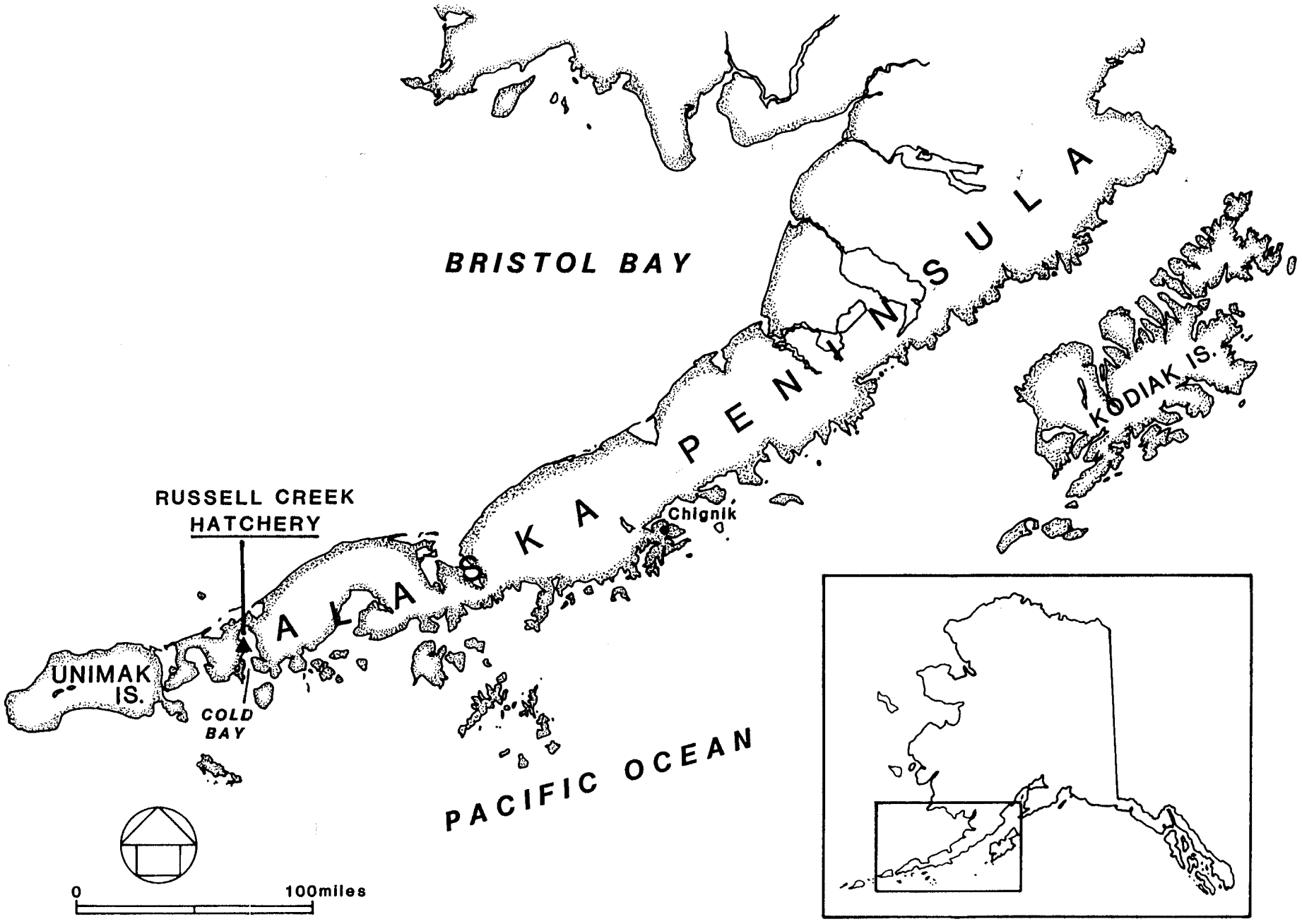

Figure 6.2. Map of Alaska Peninsula.

salmon eggs from **Monashka Creek** will be used for educational projects in Kodiak schools. Resultant fry will be returned to Monashka Creek.

Kitoi Bay Hatchery is located on Afognak Island at the head of Kitoi Bay at the north end of Marmot Bay. The metal-frame hatchery building was constructed in 1965 after it was destroyed during the 1964 earthquake. The primary group served by the hatchery is the Kodiak commercial purse-seine salmon fishermen. The operational and capital costs of Kitoi Bay Hatchery are paid by KRAA with a cooperative agreement between KRAA and the FRED Division. The main goal of the Kitoi Bay Hatchery is to increase the number of returning adult pink, chum, sockeye, and coho salmon passing through the fishery, and to increase the commercial harvest in areas that historically did not produce good or sustained catches; i.e., cape fisheries in the Duck Bay/Izhut Bay areas. In conjunction with the Sport Fish Division, Kitoi Bay Hatchery also provides coho salmon fingerlings for programs designed to create recreational salmon fisheries along the Kodiak road system.

A pilot project at Kitoi Bay Hatchery that uses subyearling (age-zero) sockeye salmon was continued in 1991. Smolts released were slightly larger than the naturally occurring age-zero sockeye salmon smolts found in the wild. This project is expected to produce several hundred thousand adult sockeye salmon for harvest in the future. New ultraviolet water-treatment units were installed in 1991; this allowed expansion of the Kitoi Bay Hatchery's chum and sockeye salmon production.

Russell Creek Hatchery is located at the tip of the Alaska Peninsula, about three miles southwest of the town of Cold Bay and about 1.5 miles upstream from salt water on Russell Creek. The hatchery, originally constructed in 1977-1978, has the potential of being one of the largest hatcheries in the state system, with a capacity for 250 million pink and chum salmon eggs. Reconstruction efforts by hatchery personnel corrected several design problems and added a large complex of aluminum raceways. At full operation, this hatchery will tremendously enhance the local commercial, subsistence, and sport fisheries.

The original plan for the hatchery was to produce chum salmon, and hatchery staff spent several years successfully producing a return. However, problems created by the False Pass fisheries controversies created several program changes, and after discussions and public hearings, the current pink and chum salmon program was reestablished in 1989.

Fish produced by Russell Creek Hatchery are taken by commercial fishermen in the Sand Point-King Cove-False Pass areas, and by sport fishermen harvesting returning salmon from Russell Creek and Cold Bay. Hatchery-produced sockeye salmon are taken in the Mortensens Lagoon subsistence fishery.

Because of a low level of wild stock pink salmon returning to Russell Creek, an effort to increase returns has been underway, beginning with the odd-year stock introduced from Kitoi Bay Hatchery in 1987 and release of 3.5 million pink salmon into Russell Creek in the spring of 1991. Eight million pink salmon eggs are currently incubating at Russell Creek Hatchery. These are the result of fry released from eggs taken from earlier returns to the hatchery.

Because there were no hatchery-produced fish returning to Russell Creek Hatchery this year, wild fish had to be used as brood stock. A total of 12.6 million chum salmon eggs was

taken. Fry will be released into Russell Creek after a short feeding period in the freshwater-raceway complex.

With funding provided by the Aleutians East Borough, Russell Creek Hatchery reestablished its sockeye salmon program in 1991. Over 1 million eggs were taken at Mortensens Lake. These will be incubated and reared for a short time in the hatchery-isolation module, and release will be at the spawning site.

The Area M Regional Planning Team expressed a desire to enhance selected coho salmon stocks. Funding for this program is being provided by the Aleutians East Borough. There will be 75,000 coho salmon smolts produced under this program for release into Russell Creek. Adults returning from this release will primarily support local sport-fishing activities as well as the annual Russell Creek Silver Salmon Derby, but some of these fish may also be harvested in the local commercial fisheries.

Kodiak and Alaska Peninsula Highlights

- Over 100 tons of fertilizer were applied to Frazer, Malina, and Afognak Lakes to increase sockeye salmon survivals. Projects were completed in cooperation with the U.S. Fish and Wildlife Service (USF&WS) and KRAA.

- Stocking assessment continued at Spiridon Lake; 3.3 million sockeye salmon fry from Pillar Creek Hatchery were planted into the lake. Lake limnology, smolt assessment, and elevation surveys for a special fish-bypass system were completed, and the smolt-pipeline materials were transported on-site for final deployment in the spring of 1992. Without this device, smolts would be killed by the cataracts and falls of the outlet stream.

- Post-fertilization studies were continued at Karluk Lake. Survey results indicate abundant levels of zooplankton, a migration of 4.7 million high-quality smolts and adequate escapement levels. The Karluk Lake sockeye salmon run is now restored, as record returns of 2.2 and 2.3 million adults were produced in 1990 and 1991, respectively.

- There was a return of 16,700 adult coho salmon to Kitoi Bay projects for sport, commercial, and subsistence fisheries enhancement.

- The significant return of approximately 75,000 chum salmon to the Kitoi Bay Hatchery allowed for a record egg take of 25.2 million eggs.

- Local support for the Russell Creek Hatchery was developed with a contribution of $52,000 from the Aleutians East Borough to reestablish the sockeye salmon program at Russell Creek Hatchery and to assist the coho salmon smolt program.

- The Area M Regional Planning Team and Aleutians East Borough are cooperating to support the coho salmon program by underwriting the cost of a program to produce up to 75,000 coho salmon smolts. These smolts will be released into Russell Creek in the spring of 1992. In addition, the City of Cold Bay has volunteered labor for an

egg take at Russell Creek for 100,000 coho salmon eggs. The cost of incubation will be underwritten by the Borough. The rearing and fish-culture duties may be part of a cooperative effort with the local school system.

- In an effort to diversify the economy of St. George (Pribilof Islands) through fisheries development, 100,000 pink salmon fry were transferred from Russell Creek Hatchery to an incubation facility located near the new boat harbor.

- A cooperative agreement with the University of Magellan in Chile was established to foster informational exchange for shellfish mariculture.

- King crab enhancement planning was initiated in 1991. A grant of $15,000 was secured from the Alaska Science and Technology Foundation to research the enhancement option for restoring this important resource.

- Cooperative contracts were established with KRAA for salmon-enhancement work in the Kodiak area for a total amount of $1,272,186.

Kodiak and Alaska Peninsula Returns and Fishery Contributions

The total return of 1,642,000 pink salmon to Kitoi Bay Hatchery included a commercial catch of 1,390,700 and brood stock/escapement of 251,000. An additional 31,700 chum salmon were caught in the commercial fishery.

The Karluk Lake sockeye salmon population and commercial fishery continues to rebuild after 50 years of depressed returns. The total return of 2,510,000 sockeye salmon included 1,376,000 in the commercial catch and 1,134,000 in escapement. This year was the second return that saw the influence of lake fertilization. The catch for the past two years has been the best on record going back to 1926.

The Frazer Lake sockeye salmon returns continue to show improvement. This was the third consecutive year that the Frazer Lake sockeye salmon commercial catch was over 800,000; this year's catch was a record 1,494,600. Frazer Lake, which was a barren system for salmon until it was stocked in the 1950s, is the most successful sockeye salmon introduction in North America. While the Commercial Fisheries Division operates the ladder facility, the FRED Division is, in cooperation with KRAA, fertilizing the lake system.

The coho salmon returns to the Village of Port Lions were excellent with over 5,000 fish returning. The villagers caught enough salmon to meet all of their subsistence needs.

The first returns from Pillar Creek Hatchery are not expected until 1994.

Contributions of hatchery fish to the Cold Bay commercial fishery were negligible this year, as there were no returning hatchery chum salmon. Approximately 7,000 returning hatchery pink salmon were caught in the local Cold Bay commercial fishery. This facility is again into a brood stock-building phase of program development and will not see a significant hatchery return until the 1989 brood year fish return as adults.

Kodiak and Alaska Peninsula Releases

Kitoi Bay Hatchery was again a leading producer of fish. A total of 124.1 million pink salmon fry were released in 1991. Approximately 525,000 coho salmon fingerlings were released into Kodiak area lakes for commercial and sport fisheries. An additional 1.25 million sockeye salmon smolts (age-zero) were also released at Little Kitoi Bay estuary. The total number of fish released from Kitoi Bay Hatchery, all species combined, was over 125 million.

During 1991 Russell Creek Hatchery released 3.5 million pink salmon fry and 5 million chum salmon fry. A total of 75,000 coho salmon smolts will be released in 1992.

There were 3.3 million fed sockeye salmon fry released into Spiridon Lake in July 1991 from the Upper Station Lake donor stock. Fry were transported by float plane and released at the lake surface.

Kodiak and Alaska Peninsula Egg Takes

A total of 170 million pink salmon, 25.2 million chum salmon, and 1.0 million coho salmon eggs were taken at Kitoi Bay Hatchery to expand salmon enhancement.

Eight million pink salmon and 12.6 million chum salmon eggs were taken from Russell Creek in the summer of 1991. A coho salmon egg take of 300,000 eggs was conducted to continue the stocking program, supported, in part, by the Aleutians East Borough.

The sockeye salmon enhancement program in Kodiak expanded with egg takes for two projects: 6.5 million eggs for the Pillar Creek Hatchery and 2.3 million eggs from Upper Station Lake for Little Kitoi Bay.

CHAPTER 7

ARCTIC-YUKON-KUSKOKWIM

Summary of FRED Projects

The "northwest" portion of the Arctic-Yukon-Kuskokwim (AYK) area encompasses a vast portion of western Alaska, extending north of Kotzebue Sound above the Arctic Circle to the Kuskokwim Bay area to the south. The coastline extends over 1,300 miles, with a large portion of the area south of Norton Sound located within the boundary of the Yukon Delta National Wildlife Refuge. Of the approximately 26 million acres of land within the refuge boundary, 73% is currently under federal government jurisdiction, the remaining being native or nonfederal entitlements. The larger portion of two major salmon-migration rivers traverse the refuge, the Yukon, and Kuskokwim. The coastal plain, which is barely above sea level, is primarily a flat and featureless, low-lying wetlands dotted with thousands of lakes. Most streams in the area are low gradient, and many of the larger rivers that empty into the Bering Sea are under tidal influence up to 40 stream miles above their mouths. They are characterized by heavy silt loads caused by suspended sediment consisting of silt and very fine sand.

Fisheries enhancement efforts in western Alaska have been relatively minor since the FRED Division was created in 1971. The exception has been the **Kotzebue Sound** area where a state hatchery facility has been in operation since 1982. The Sikusuilaq Springs Hatchery, located approximately 30 miles north of Kotzebue on the Noatak River, has provided fall chum salmon to the commercial and subsistence fisheries.

The **Norton Sound** area supports a commercial, subsistence, and sport fishery and extends from Cape Douglas near the Bering Strait south, approximately 500 miles to Canal Point Light. All five species of Pacific salmon occur in the area, with chum salmon being the most abundant species, followed by coho, pink, and chinook salmon. Sockeye salmon are rare and in low abundance throughout the area. The Norton Sound area is divided into six subdistricts, each containing at least one major spawning stream. The Nome Subdistrict salmon stocks are less abundant than stocks from other portions of Norton Sound, with fisheries demands exceeding production in most Nome area streams. Management actions in 1991 resulted in the closure of subsistence as well as commercial and sport fisheries in an effort to reach minimum escapement goals. The problem is exacerbated by habitat degradation resulting from mining and road construction. During the past several years, salmon stocks have experienced a steady decline, particularly chum salmon.

The coastal area around **Chevak and Nelson Island** is predominantly a subsistence salmon fishery with most local stocks in low abundance throughout the area. Although there has been some local interest in developing a commercial salmon fishery in the area,

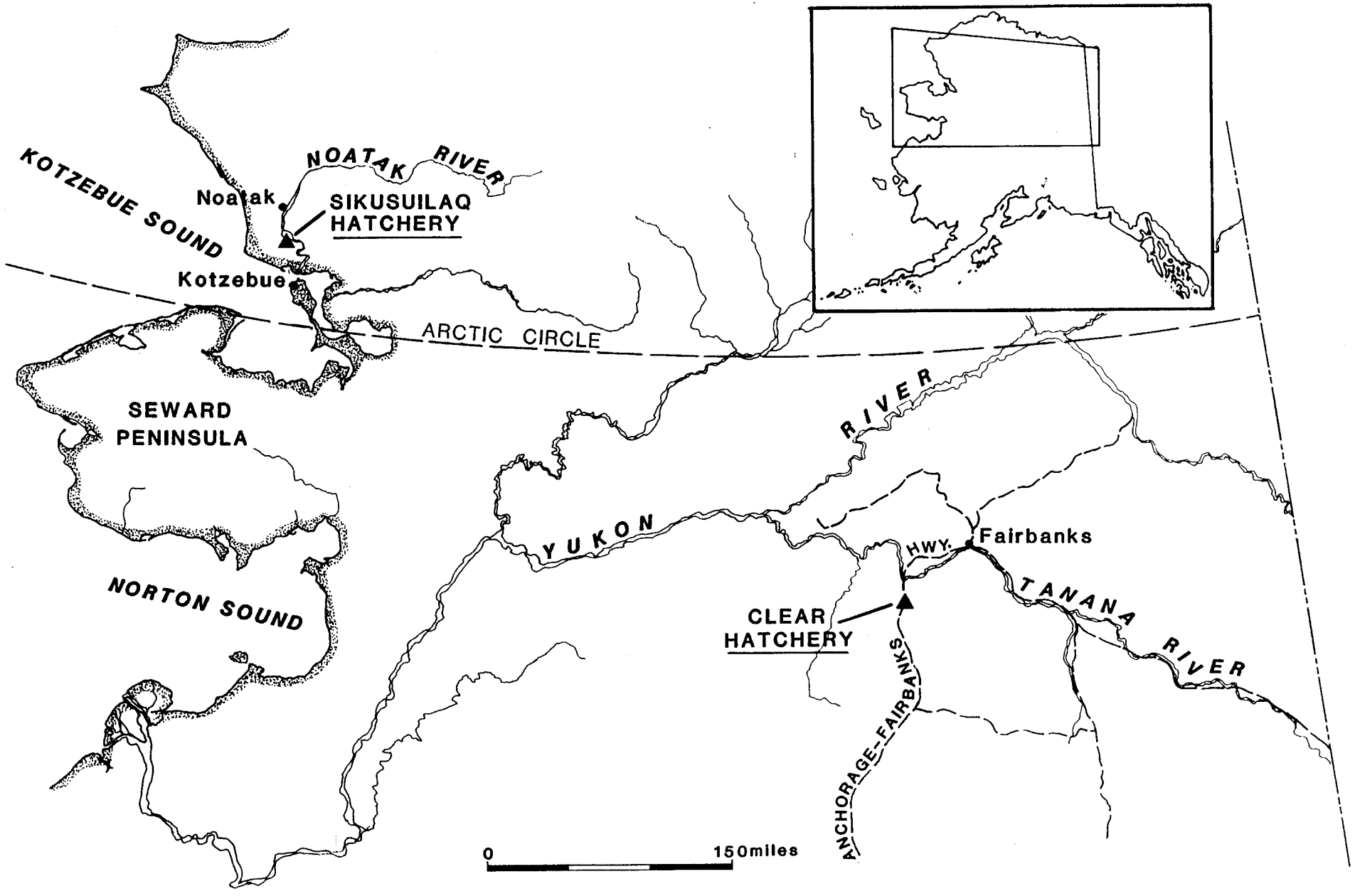

Figure 7.1. Map of Arctic-Yukon-Kuskokwim.

none now exists. All five species of Pacific salmon traverse through the area on their migration to the Yukon River and Norton Sound area rivers.

Two FRED Division hatcheries are located in the AYK area (Figure 7.1). Clear Hatchery at the Clear Air Force Station produces Arctic grayling, Arctic char, and lake trout for interior Alaskan sport fisheries. Sikusuilaq Springs Hatchery on the Noatak River near Kotzebue Sound produces fall chum salmon for the Kotzebue area commercial and subsistence fisheries.

Clear Hatchery, near Nenana, was completed in January 1980. It has produced coho salmon, sheefish; Arctic grayling, Arctic char, lake trout, and rainbow trout predominantly for Interior sport fisheries, and historically produced fall chum, chinook, and coho salmon for the Tanana/Yukon River commercial and subsistence fisheries. Since Clear Hatchery is interior Alaska's only hatchery, it is a center for developing rearing programs for Interior fisheries. The facility currently produces Arctic char and Arctic grayling. The site was selected partly because of the availability of heated waste water which allows a flexible rearing program.

The Arctic char project at Clear Hatchery is designed to develop, maintain, and expand domestic brood stock to replace wild-stock egg takes and to continue to provide fingerlings, subcatchables, and catchables for interior and southcentral Alaska sport fish programs. The Arctic grayling project is designed to maintain and expand a domestic brood stock to replace a wild egg take and to continue to provide fry and fingerlings to statewide sport fisheries projects. Additional emphasis is placed on developing techniques to increase survival levels at all stages of fish culture. The lake trout program presently depends on a remote egg take from a wild brood stock to ultimately provide enhancement and a mixed fishery in a limited number of lakes.

The lake trout program for 1991 has been cancelled from Clear Hatchery because BKD was detected in the wild brood stock used, and destructive sampling is required for donor adults. A replacement wild brood-stock source is currently under investigation by the Sport Fish Division.

Fish released from the Clear, Fort Richardson, and Big Lake Hatcheries into various waters of the Tanana Drainage over the past few years accounted for the harvest in 1990 of approximately 65,000 rainbow trout, 15,000 landlocked coho salmon, 2,500 Arctic grayling, and 500 Arctic char in **roadside fisheries** near Fairbanks, Delta Junction, and Tok. This FRED Division hatchery-produced sport harvest represented around 65% of the annual sport fish harvest of all species in the entire Tanana Valley in 1990. The 1991 sport fishery harvest of FRED hatchery-produced fish is expected to slightly exceed the overall 1990 harvest of 83,000 fish. In 1991 the portion of the overall sport harvest composed of FRED Division hatchery fish is expected to have increased to a level near 75% due to continued shortages of wild stocks in interior Alaskan waters.

Over 20,000 anglers fished in 1990 in waters of the Tanana Valley that are totally dependent upon fish from the Clear, Fort Richardson, and Big Lake Hatcheries. These anglers spent about 90,000 days fishing for hatchery-produced fish during 1990, representing almost 50% of the sport fishing effort that took place in interior Alaska that year. The 1991 sport effort of FRED Division hatchery-produced fish is expected to be about 100,000 man days. In

1991 the portion of the overall sport fishing effort in interior Alaska dependent upon FRED Division hatchery fish is expected to have increased to a level near 65% because of regulatory closures of several recreational fisheries due to wild stock conservation concerns.

FRED Division staff assisted Sport Fish Division staff with the cost-effective construction and operation of experimental floating net pens that were used to rear rainbow trout, lake trout, Arctic grayling, Arctic char, and kokanee salmon for release into **Harding Lake** near Fairbanks. In 1990 and 1991 almost 350,000 fingerlings and larger-sized fish were released each year from this experimental facility to augment the sport fishery.

In 1991 FRED Division staff assisted Sport Fish Division staff with the construction and operation of a floating net-pen structure situated in a gravel pit near **Chena** Hot Springs Road that was used to experimentally rear Arctic grayling to fingerling size. Successful results from this experiment, coupled with successful rearing of large yearling Arctic grayling at Clear Hatchery, and coupled with other technical assistance from FRED Division staff, are being used to develop a cost-effective rehabilitation plan for the depressed Arctic grayling sport fishery of the Chena River, once the largest recreational fishery for Arctic grayling in the world.

The **Sikusuilaq Springs Hatchery** is located on the Noatak River about halfway between Kotzebue and Noatak Village. Funding originated from the 1978 Bond Issue and construction costs were about $3 million. The original legislative intent called for a demonstration hatchery to be built and operated at a suitable site in the Kotzebue area, so the practicality of hatchery operations in the Arctic could be assessed and information gathered for the design of a full production salmon hatchery, if the original operation was successful. During 1987 the capacity of the hatchery was expanded from 2 million to 10 million eggs. Plans are being developed to expand the hatchery.

Around 35,000 adult chum salmon from Sikusuilaq Springs Hatchery releases were forecast to return to the Kotzebue area during the summer and fall of 1991. The commercial fishery harvested at least 20,000 of these fish. Subsistence users harvested at least 5,000 of these returning fish and approximately 7,000 returned to Sikusuilaq Springs. These fish provided 10.8 million eggs for incubation at the hatchery this year. Because of this excellent return, this was the first year no remote egg take was necessary. All of the carcasses from the 1991 egg take and excess male salmon at Sikusuilaq Springs Hatchery were given away to local dog mushers and subsistence users.

In 1991 project activities in the **Nome** area focused primarily on evaluating three drainage systems, the Nome, Snake, and Solomon Rivers, for possible application of instream-incubation technology. Of the three sites studied, only Shovel Creek, a tributary of the Solomon River, did not meet all of the necessary criteria.

Two experimental instream test-incubator boxes were installed on **Hobson Creek**, a short distance above its confluence with the Nome River, located approximately 20 miles upstream from the City of Nome. A limited pink and chum salmon egg take was conducted (22,000 and 20,000 eggs, respectively) on the Nome River, and the resultant eggs were seeded into the incubation boxes at Hobson Creek. Observations and data collected this winter will be analyzed to determine the feasibility of this technology, and knowledge gained will better

enable FRED Division biologists to develop enhancement and rehabilitation strategies for 1992.

Another experimental instream test incubator box was installed on **Boulder Creek**, 1.5 miles from its confluence with the Snake River, approximately 15 miles from the City of Nome. An estimated 15,000 pink salmon eggs were collected from the Snake River and placed in the incubation box with a temperature-recording device.

Survey work conducted on **Shovel Creek** revealed that minimal site-gradient requirements could not be met. Additionally, a major road-construction project was impacting the immediate area around Shovel Creek. This project was put on hold; however, additional site investigation is warranted and, possibly, some habitat-improvement work will be necessary. The **Solomon River** needs fisheries enhancement and habitat rehabilitation work, as do most streams in the Nome area, as it has experienced severe salmon stock declines. In the early 1900s, there were 13 mining dredges operated in the Solomon River watershed alone.

Preliminary site investigation was conducted on **Anvil Creek** as part of a cooperative effort between Alaska Gold Company and the FRED and Habitat Divisions. The Anvil Creek area has been heavily mined in the past with portions of the creek having been diverted into several settling ponds and diversion channels. It is anticipated that riparian habitat restoration will be conducted next year. Habitat-improvement studies, water-quality monitoring, and site planning will continue through the winter.

Based on requests from the City of Elim to investigate potential fisheries enhancement opportunities in the **Elim** area, several sites were investigated for possible installation of instream incubator boxes, including Elim Creek within the Village of Elim; Iron Creek, approximately 8 miles east of Elim; and Quiktalik Creek, approximately 2 miles west of Elim. There is also considerable interest in developing a salmon hatchery on the **Kwiniuk River** in the vicinity of Elim where site evaluation and developmental planning are proceeding, along with studies to assess physical, biological, and chemical parameters of the water supply.

An experimental test-incubation box was installed on **Quiktalik Creek**. This creek currently supports a small run of pink and coho salmon. If this site proves to be successful, it is anticipated that a limited egg take may occur here in 1992.

Preliminary reconnaissance surveys and feasibility and environmental-monitoring studies were also conducted in the lower Kuskokwim Delta area, including the **Chevak** area near the "Volcano Cones," located approximately 45 miles southeast of Chevak Village on the Coastal Plain of the Yukon Delta National Wildlife Refuge. Water quality and quantity were tested and potential stream-incubation sites investigated. The inherent physical characteristics of this area and its remoteness pose many difficult and unique challenges for developing an economically viable program. Preliminary findings warrant additional field work in this area before a fisheries enhancement strategy can be developed.

Preliminary reconnaissance surveys of area streams around Nelson Island were conducted and a potentially viable test instream incubation-box site was located on a tributary of the Ikalugtulik River, northeast of the village of Tununak. A test box was installed and, if successful, a limited egg take may be possible in 1992.

The **Nome-Beltz High School** Fisheries Program has entered its second year of a highly successful cooperative program between the high school, the Bureau of Land Management, and the FRED Division. The program has attracted nationwide attention of the Washington, D.C.-based Times Mirror Conservation Council, and it may provide a basis for educational programs throughout the nation. This year students and department personnel collected both coho and pink salmon eggs from nearby streams. Under laboratory-like conditions, the students will emulate natural environmental conditions found in the parent stream. The knowledge acquired will also help to provide FRED Division personnel with valuable data on fry-developmental stages through the winter in a subarctic environment.

FRED Division personnel also assisted the **Unalakleet and Shaktoolik Schools** to establish fisheries programs in 1991. A coho salmon egg take was conducted by students from the Unalakleet School under the supervision of FRED Division personnel. Eggs were transported to both schools and seeded into incubators as part of the fisheries curriculum.

Arctic-Yukon-Kuskokwim Highlights

- A total of 90 separate lakes were stocked with 3 different species from Clear Hatchery.

- The gas-stabilization project at Clear Hatchery is almost complete and operational. The installation of this state-of-the-art technology will remove the lethal nitrogen supersaturation from the water and increase dissolved-oxygen levels by 125%. (If successful, this is expected to result in a 75% + increase in production capabilities.)

- Fish released from the Clear, Fort Richardson, and Big Lake Hatcheries into waters of the Tanana Drainage have accounted for the harvest of approximately 65,000 rainbow trout, 15,000 landlocked coho salmon, 2,500 Arctic grayling, and 500 Arctic char in roadside fisheries near Fairbanks, Delta Junction, and Tok in 1990.

- FRED Division hatchery production represented about 65% of the annual sport fish harvest of all species in the entire Tanana Valley in 1990.

- In 1991 the portion of the overall interior Alaska sport harvest comprised of FRED Division hatchery fish is expected to have increased to a level of around 75% because of continued shortages of wild-stock fish in interior Alaskan waters. The 1991 sport fishery harvest of FRED Division hatchery fish is expected to slightly exceed the overall 1990 harvest of 83,000 fish.

- In 1990 over 20,000 anglers fished in waters of the Tanana Valley that are dependent upon fish from the Clear, Fort Richardson, and Big Lake Hatcheries. These 20,000 sport fishers spent nearly 90,000 days fishing for hatchery-produced fish, representing almost 50% of the sport-fishing effort that took place in interior Alaska in 1990.

- Three experimental egg-incubation boxes were installed in tributaries of the Nome and Snake Rivers as part of a pilot project to study the potential of instream-incubation technology in western Alaska. Small pink and chum salmon egg takes were conducted.

- An experimental egg-incubation box was installed in Quiktalik Creek, outside the village of Elim, approximately 90 miles east of Nome on Norton Sound.

- The Nome-Beltz High School Fisheries Program, a cooperative program between the high school, Bureau of Land Management, and FRED Division, has attracted national attention through the Washington, D.C.-based Times Mirror Conservation Council.

- The June 1991 fry release of 7,365,000 was a new record for Sikusuilaq Springs Hatchery.

- Returns of adult chum salmon to Sikusuilaq Springs Hatchery were greater than previously recorded and provided enough brood stock to fill the hatchery to its current capacity. This is the first time no remote egg take was necessary.

- The 1991 Sikusuilaq Springs Hatchery egg take of 10.8 million eggs is a new facility record.

Arctic-Yukon-Kuskokwim Returns and Contributions

The sport fisheries of interior Alaska are heavily dependent upon fish released from the Clear, Fort Richardson, and Big Lake Hatcheries. Approximately 10 years ago, the sport fisheries of interior Alaska had an annual fishery of around 100,000 angler days in which nearly 25,000 hatchery-produced fish were harvested, representing a minor portion of the overall sport catch. In 1990-1991 the annual sport fishery is almost 200,000 angler days, in which almost 100,000 hatchery-produced fish are taken annually and represent the majority of the sport fish catch in interior Alaska. The Piledriver Slough, Birch Lake, Quartz Lake, Chena Lake, Harding Lake, and various other interior Alaskan sport fisheries are dependent upon the annual release of hatchery-produced fish.

Preliminary analysis of the return to Sikusuilaq Springs Hatchery indicate that at least 20,000 chum salmon contributed to the 1991 Kotzebue Sound commercial harvest. The 1991 subsistence harvest of hatchery fish exceeded 5,000 chum salmon. Returns to Sikusuilaq Creek totaled 6,700 chum salmon.

Arctic-Yukon-Kuskokwim Releases

During June 1991, 7,365,000 chum salmon fry were released from Sikusuilaq Springs Hatchery at an average weight of 0.408 g each.

The 1992 chum salmon fry release from Sikusuilaq Springs Hatchery should be about 9.5 million fed fry that should return as an estimated 95,000 adult salmon during the years 1994 through 1997.

A total of 480,400 Arctic char was released from Clear Hatchery. These ranged in size from 29.5 g to 2,134 g. Approximately 1,301,000 Arctic grayling that weighed between 4.0 g and 252.0 g were released, and an estimated 52,900, 4.2-g lake trout were also released from Clear Hatchery.

Arctic-Yukon-Kuskokwim Egg Takes

Approximately 10.8 million eggs were taken from fish returning to Sikusuilaq Creek.

At Clear Hatchery, over 2 million Arctic char eggs and nearly 3 million Arctic grayling eggs were taken during 1991.

CHAPTER 8

PROGRAM PROJECTIONS FOR 1992

The FRED Division uses many strategies other than hatcheries to rehabilitate, enhance, and develop fisheries. Several of these strategies, including operation of fish ladders that allow salmon to reach unutilized spawning areas, lake fertilization, habitat improvement, and fish-planting programs, are much more difficult to evaluate than standard hatchery production. For lake fertilization and fish-planting projects, tagging and use of sonar counters allow for evaluation, often on a par with hatchery evaluation, but at a much greater cost. Fish ladders and habitat-improvement projects are difficult to evaluate; i.e., estimating the increased number of fish attributable to a project. Often, if evaluation is biologically feasible, it is cost-prohibitive. Since hatchery production is the most quantifiable strategy, it often is used as a standard by which the effectiveness of fisheries enhancement is measured. Table 8.1 presents projected numbers of fish expected to return to a diverse group of FRED Division projects, excluding fishpass projects or projects involving transfers of eggs or fish to PNP operators.

Projected Returns for 1992

The projected number of pink salmon returning to FRED Division projects in 1992 is just over 3.5 million. The projected number of sockeye salmon returning in 1992 is just over 2.9 million. Because this number does not reflect fishpasses and some lake-enrichment projects, such as Karluk and Frazer Lakes, this number underestimates the actual return.

Table 8.1. A projection of the number of salmon expected to return in 1992 as a result of FRED hatcheries and projects (excluding fishways and PNP transfers).

Return site	Numbers by species					
	Chinook	Coho	Sockeye	Chum	Pink	Steelhead
ARCTIC-YUKON-KUSKOKWIM						
Sikusuilaq				56,000		
AREA TOTALS:				56,000		
COOK INLET						
Big Lake		4,300	110,000			
Cottonwod Drainage		3,500				
Wasilla Creek		3,600				
Willow Creek	5,200					
Little Susitna		15,000				
Crooked Creek	6,500	2,500				1,000
Ninilchik River	2,000					
Chenik Lake			125,000			
Paint River			30,000			
Tustumena			80,000			
Tutka				55,000	590,000	
Halibut Cove	2,100				165,000	
Homer Spit	4,200	6,500			3,000	
Seldovia Bay	2,000					
Leisure Lake			100,000			
Port Dick Lake			9,200			
Kirschner Lake			40,000			
Hazel Lake			50,000			
Caribou Lake		10,200				
Resurrection Bay	4,000	9,000				
Ship Creek	3,000	2,800				
Eagle River	900					
AREA TOTALS:	29,900	57,400	544,200	55,000	758,000	1,000
KODIAK-AK. PENINSULA						
Karluk			1,600,500			
Kitoi		100	15,000	40,000	2,587,000	
Kodiak other	300	1,200	40,000		134,000	
Russell Creek		1,750	10,000		80,000	
AREA TOTALS:	300	3,050	1,665,500	40,000	2,801,000	0
PRINCE WILLIAM SOUND						
Gulkana			212,200			
Main Bay			341,000	80,000		
AREA TOTALS:	0	0	553,200	80,000	0	0

Table 8.1. Continued.

Return site	Numbers by species					
	Chinook	Coho	Sockeye	Chum	Pink	Steelhead
SOUTHEAST - SOUTHERN						
Bakewell/Badger			23,080			
Big Salt	221					
Cable Creek		2,091				
Deer Mountain	4,249	2,319				136
Hugh Smith Lake			12,466			
Klawock		65,537	25,908			500
Margaret Lake		1,523				
Marx Creek				37,500		
McDonald Lake			136,704			
Reflection Lake		1,513				
Rio Roberts		758				
Thorne Bay	779					
Ward Creek		3,076				
SOUTHEAST - CENTRAL						
Crystal Lake	23,500	4,700				200
Earl West Cove	17,700					
Farragut River	5					
Harding River	75					
Ohmer Creek	3,000					60
SOUTHEAST - NORTHERN						
Chilkat Ponds		1,200				
Eliza Lake						
Indian Lake		1,100				
Indian River	50					
Jerry Myers	40					
Juneau/DJ	4,400					
Lutak Inlet	200					
Limestone Inlet				60,000		
Snettisham	1,600			15,000		
Twin Lakes	3,000					
AREA TOTALS:	58,819	83,817	198,158	112,500	0	896
STATE TOTALS:	89,019	144,267	2,961,058	343,500	3,559,000	1,896
	GRAND TOTAL:		7,098,740			

CHAPTER 9

FISH HABITAT RESTORATION AND IMPROVEMENT

The FRED Division continues to develop and pursue fish habitat restoration and improvement projects in several areas of the state, with major emphasis in the Anchorage area, Prince of Wales Island, and northern southeast Alaska. The goal of these projects is to restore, create, or improve fish habitat so that long-term natural productivity of the waters in the state are improved. These projects are oriented to include public and community participation and involvement, and to enhance public education and awareness. Public participants have included sportsmen groups (e.g., Alaska Flyfishers), the Boy Scouts, Girl Scouts, students and teachers, business people, and construction firms. Fishpass projects were particularly evident in the Southeast Region. Besides the projects described below, FRED Division staff also participated in bioenhancement on Tuya/Tahltan Lakes and Virginia Lake/Mill Creek.

Anchorage Area

Campbell Creek - Campbell Creek, and other drainages around Anchorage, are the focus of stream restoration and improvement work. Beginning on 1 July 1991, the Anchorage area stream rehabilitation project was solidified in response to this need to coordinate aquatic resource education, volunteer activities, and community involvement. In addition, a grant was obtained from the Alaska Science and Technology Foundation to develop and evaluate technology for fish habitat improvement. In addition to creating new fish habitat, projects are designed to incorporate public involvement and public education as well as project evaluation that will result in improvements of methods and techniques. A waterflow-control structure was installed in Campbell Creek Park to divert the main channel of the stream away from a Municipal Park picnic area. Flow was controlled, siltation reduced, rip rap placed along the previously eroding bank, and boulders installed to develop resting areas for fish.

Campbell Creek Revegetation - With assistance from FRED Division staff, Boy Scout Troop 84 transplanted wild willow plants into pots donated by three local greenhouses. The scouts will return to the site this winter to cut and store willow cuttings. These plants will be used to revegetate Campbell Park Slough next spring after it is excavated. The Alaska Flyfishers assisted with the installation of a pipe bypass through a beaver dam to allow juvenile fish passage into new rearing habitat.

SKIF - The FRED Division participated in the Anchorage SKIF (Streams, KIds and Fish) Committee that proposed the development of an integrated, multidisciplined approach to habitat restoration, fisheries enhancement, and educating school children about fish and the environment. Members include: ADF&G, the Municipality of Anchorage Assembly, the Anchorage School District, and the Municipality's Department of Health and Human Services. The Municipality of Anchorage Assembly recognized the importance of aquatic resources and the need for both enhancement and better

community understanding of this resource by creating the special Anchorage Aquatic Resource.

Southern Southeast Area

Bennett Creek - Bennett Creek flows through a clearcut area on native-owned land on Prince of Wales Island. The lower 1.2 miles of stream was destabilized and diverted from its original channel in several places. The project objectives were to increase and stabilize coho salmon-rearing habitat throughout the lower reaches of the stream, and to maintain old trees and rootwads. A total of 25 log structures or tree revetments were placed in the channel at 17 sites. Wind-thrown debris was removed from one site, and an inactive beaver dam was breached at another to allow the stream to flow in its original channel. City of Klawock Summer Youth Interns, volunteers, and FRED Division personnel worked cooperatively to develop access along the stream, prepare the site, and breach the beaver dam. Although pink and chum salmon were found in initial escapement surveys, the increase in rearing habitat is expected to improve coho salmon production.

Prince of Wales Sockeye Salmon - A basin-wide approach to improving sockeye salmon production in Klawock Lake includes extensive surveys of the most productive streams in the drainage (Threemile, Hatchery, Halfmile, Blue, and No Name Creeks). Work is being planned in conjunction with the Klawock High School fisheries class.

Prince of Wales Island Revegetation - Procedures for revegetation of disturbed sites on Prince of Wales Island are being developed in consultation with Ms. Nancy Moore from the Plant Materials Center in Palmer, Alaska. Vegetative associations have been examined at various and widely separated sites that are representative of the habitat types on Prince of Wales Island. Three native plant species and 7 native grass species were planted using two different fertilization regimes. In the initial evaluation, varieties of tufted hairgrass, reedgrass, and red fescue showed the most promise.

Misty Fiords National Monument, Portland Canal - The FRED Division and USFS, Misty Fiords National Monument staff members have been cooperatively working since 1984 on stream rehabilitation and salmon stock enhancement projects in the lower Salmon River area at the northern end of the Portland Canal. Project efforts have been concentrated around Fish Creek, one of the main tributaries to the Salmon River and, potentially, a major salmon-producing stream. Previously destroyed by flooding, much of the habitat is now protected by two dikes that are adjacent to the river; the river is now undergoing a stabilization process. Opportunities for creating new spawning and rearing habitat have been identified, as well as restoration of habitat not presently usable.

Marx Creek Spawning Channel - The original Marx Creek Spawning Channel, which somewhat parallels Fish Creek, was excavated by the USFS in 1985. The FRED Division led the chum salmon-colonization program, transferring brood stock from Fish Creek to the spawning channel over a 4-year period. With an unlimited supply of optimally sized gravel and abundant upwelling water, incubation survival from the

channel has been as high as 57%. The USFS extended the channel in 1989, and total channel length is now 1.8 km. Severely depressed adult escapement has precluded brood stock transfer to the new section and also has not allowed natural colonization.

Marx Creek Revegetation - The USFS, Misty Fiords National Monument contracted with the FRED Division to revegetate the area between Salmon River Road and the Marx Creek Spawning Channel, thus providing a screen to keep road dust out of the spawning gravel and to help shade the channel. Approximately 400 willow cuttings were planted along the streambank, and 60 bundles of scions were planted on the slope of the road.

Bryce Creek - Bryce Creek is an isolated slough located between Fish Creek and the Salmon River. A field trial was conducted in 1991 to determine if Bryce Creek is suitable rearing habitat. In May a combined ADF&G and USFS crew trapped and moved 312 yearling coho salmon from Fish Creek to Bryce Creek. Each fish was freeze-branded with one of five distinct marks, to indicate the planting location. Followup trapping in August and September indicated excellent growth and survival. The USFS plans to excavate a connecting channel from Fish Creek to Bryce Creek in 1992 to allow access for coho salmon and Dolly Varden.

Northern Southeast Area

Big Boulder Creek - Work on Big Boulder Creek, a tributary to the Klehini River along the Haines Highway, progressed in 1991. The stream provides spawning habitat for a subpopulation of Chilkat River-system chinook salmon. Habitat quality has degraded partially as a result of highway construction dating back to the 1940s. A hydrologic study was completed in January, providing information used to evaluate the design of the highway bridge reconstructed in 1991. Methods for instream-habitat enhancement described in the study were included in the design of structures installed in the stream in 1991. The structures consisted of 11 clusters of 3 boulders each. They were placed in the stream to improve spawning habitat available to chinook salmon. The clusters were part of the mitigation for impacts caused by construction of the new bridge. A water intake was installed in the bridge-approach dike to supply streamside-incubation boxes at Big Boulder Creek. An incubation box and a pipeline supplying the box from the intake were installed this fall. This project is being pursued in cooperation with the Alaska Department of Transportation and Public Facilities (DOT/PF) and Haines NSRAA. Chinook salmon eggs can now be collected from spawners returning to the system, incubated in the streamside boxes, and released as fry in the stream.

Haines Airport Mitigation - DOT/PF is in the process of reconstructing the Haines Airport. As mitigation for habitat losses resulting from the project, several habitat-improvement structures were designed and installed in the area.

Haines Highway Reconstruction - As an important transportation corridor to the Interior, the Haines Highway will undergo a major reconstruction from the Chilkat River crossing to the border. Several sections are to be straightened, possibly requiring a road portion to be constructed on the floodplain margin of the Klehini River. This

area possesses valuable spring-fed stream channels supporting spawning and rearing populations of chum, chinook, and coho salmon and Dolly Varden. Preliminary review of highway-realignment alternatives began in the fall of 1991. Potential areas for enhancement are being monitored this winter for groundwater and surface hydrology. The FRED Division, DOT/PF, and NSRAA are working cooperatively to develop plans for potential habitat-enhancement applications along the highway route.

Haines One Mile Creek - One Mile Creek near Haines is an important spawning and rearing area for cutthroat trout. It is currently impacted by a partial migration barrier caused by improper placement of a road culvert. A fishway and outlet-control structure were designed for the culvert, and the requisite habitat permit obtained for the work. The structure will be installed during a "work window" in the spring of 1992 after the emergence of fry and prior to the spawning migration of adult cutthroat trout.

Duck Creek - Staff are developing a picture of the history and extent of impacts on Duck Creek, a small stream draining the central Mendenhall Valley in Juneau.

Jordan Creek - Logging, gravel pits, diversions, dams, road crossings, and residential and commercial development have affected the entire length of Jordan Creek, a stream in the Mendenhall Valley of Juneau. A small project was initiated in 1991 to control flooding caused by beaver dams adjacent to a residential area. The goal of the project is to alleviate flooding while retaining the water retention and habitat functions provided by the beaver-dam impoundments.

Fishpass Projects

In addition to the projects described below, FRED Division staff have also been involved with a fishpass constructed on Meter Bight Creek on Zarembo Island, as well as fishpasses constructed in the Kodiak area on Waterfall, Frazer River, and Afognak Island. Additional information on bioenhancement can be found in Chapter 11, Limnology and Lake Fertilization.

Sunny Creek - Located in Cholmondoley Sound, on the east coast of Prince of Wales Island, this fishpass was constructed in 1984. It has been very successful: The 1991 escapement was estimated at 45,000 pink salmon, more than twice the 1990 escapement of 16,000.

Tunga Lake - Klawock Hatchery staff planted coho salmon presmolts above this USFS fishpass during a 4-year colonization program. When the final return from this effort occurred in 1991, a 3.7% return of adults to the commercial fisheries (6,400 fish) was documented. However, results of trapping fry in September 1991 indicate that natural production of coho salmon may not be occurring in Tunga Lake. This may be due, in part, to fishpass design, as an escapement of only 25 coho salmon was documented in 1991. An additional presmolt plant (250,000) occurred in 1991. Tunga Lake is located on the west coast of Prince of Wales Island.

Cable Creek - Approximately 40,200, 14-g coho salmon were planted above the Cable Creek fishpass in 1991. Although this is the fifth year of releases in this colonization

project, few adults have returned. Therefore, FRED Division staff again took eggs from this site in 1991 (67,000). The 1991 return of adult coho salmon looked more promising, with a contribution of 762 adults to the commercial fishery. Escapement, however, was 20.

Old Franks Lakes - Fishpass construction in lower Old Franks Creek has long been endorsed as a high-priority project in southern southeast Alaska. Construction of the two fishpasses is now planned for 1992 by the USFS, Craig Ranger District. The FRED Division will be leading the bioenhancement effort, with the possible planting of sockeye and/or coho salmon fry in 1992. U.S./Canada Pacific Salmon Treaty mitigation funding is being sought for the coho salmon-planting program. The fishpasses will open up 730 acres of lake habitat and 3.8 miles of stream habitat to anadromous fish production. The decision on which coho salmon stock to use will be based on genetic analysis of coho salmon fry now being collected from Karta River, Klawock Hatchery, and lower Old Franks Creek.

Margaret Creek - In May 1991, Deer Mountain Hatchery personnel delivered 25,000 summer coho salmon smolts to Margaret Lake using a fixed-wing aircraft. Margaret Lake is located on Revillagigedo Island and flows into west Behm Canal. The Margaret Creek fishpass was built by the USFS, Ketchikan Ranger District, and opened in 1990. Sockeye salmon fry were planted in the lake in 1988, 1990, and 1991. The USFS has been conducting an extensive study of the resident cutthroat trout population since 1989, and will be able to document the effect of introducing anadromous fish. The planting of 20,000 Deer Mountain Hatchery summer coho salmon presmolts in late 1991 was cancelled because natural escapement/colonization by coho salmon is occurring, and the USFS would like to study this phenomenon.

Suntaheen River - Suntaheen River is located on the east side of Chichagof Island. The river originates in a broad valley with many ponds and channels characteristic of prime coho salmon habitat. However, two barriers prevent fish from gaining access to this habitat. In 1989 the USFS began construction of two fish ladders over the barriers. To ensure colonization above the fish ladder, the USFS and FRED Division Northern Southeast Area Office have cooperated to place coho salmon fry in the new habitat. In 1991 this effort continued. In June FRED Division staff assisted with the transport of 58,000 fry produced from eggs collected on an adjacent stream in 1990. The fry were distributed in the prime habitat. This year FRED personnel assisted with adult salmon and egg collections at nearby Game Creek. Fry produced from these eggs will be planted above the Suntaheen River fish ladders in 1992.

Harding River - A canyon 4 miles up the Harding River prevents chinook salmon from utilizing about 6 additional miles of stream habitat. The FRED Division and USFS agreed to jointly evaluate chinook salmon habitat above a partial barrier on the Harding River south of Wrangell. The FRED Division has been releasing fry above the barrier since 1987. A 5-year effort to bioenhance chinook salmon on the Harding River began in 1991. All fry resulting from the 1991 egg collection will be coded-wire-tagged and released above the Harding River canyon for bioenhancement. The USFS will improve access through the canyon, if staff decide that rock work will help the migration of returning 1986- and 1989-brood adults.

Irish Creek/Upper Keku Creek - Irish Creek and Upper Keku Creek fishways were built by the USFS in 1984 and 1985, respectively, and are in the same watershed. The FRED Division funded approximately 10% of the Irish Creek fishway construction in addition to fish-planting costs. In 1990 the USFS, with technical assistance from the FRED Division, trapped and tagged 4,400 coho salmon smolts. A rough estimate of contribution to the fisheries in 1991 from coded-wire tag recoveries is 34,100 adults (*See* Table 3.1A). The USFS, with technical assistance from FRED Division personnel, tagged an additional 2,200 Irish Creek coho salmon smolts that should return as adults in 1992. This is to be the final year of tagging smolts on Irish Creek.

Dean Creek - FRED Division personnel surveyed Dean Creek for juvenile coho salmon in June. Prior to this survey, it was believed that coho salmon bioenhancement had been unsuccessful. The presence of juvenile coho salmon found throughout the drainage now indicates that sufficient stocks exist to suspend future bioenhancement. A total of 48,100 coho salmon fry from adjacent streams was planted in Dean Creek over a 6-year period. Since this project was small in comparison to other local fishpasses, no adult evaluation was attempted using coded-wire tags. This project is considered complete.

Slippery Creek - A total of 225,000 fed fry and 678,000 unfed fry have been released in Slippery Creek from 1987 through 1990. Tag recoveries indicate that at least 490 adult coho salmon entered the fisheries this year from previous releases (*See* Table 3.1). Most of these fish were tagged as smolts in 1990 by Forestry Sciences Laboratory personnel. The tagging data show that around 81% of the coho salmon smolts above the fishpass were coded-wire-tagged, but no evaluation of adult escapement was performed to verify the tagged-to-untagged ratio. This brings the total documented contribution to the fisheries from the initial releases to 1,640 adults. The USFS constructed the fishway on this system in 1988, with an anticipated annual production of 11,500 adult coho salmon.

St. John's Creek - The USFS built the St. John's fishway in 1986, with a projected annual production of 9,240 coho salmon. Coho salmon bioenhancement efforts on St. John's Creek were initiated in 1985. Hatchery stocks were accepted for use in 1988; this resulted in 113,400 fed fry being planted above the fishpass in 1989 and 1990. Tagged coho salmon from this project first appeared in the fisheries in 1989. FRED Division staff estimate the 1991 contribution to the fisheries from this project to be 27 fish (*See* Table 3.1) and the total harvest to date at around 87 adult coho salmon. Though estimated contributions to the fisheries appear low, surveys on the watershed indicate juvenile coho salmon are utilizing the habitat above the fishpass, perhaps planting additional fry unnecessary. Adult steelhead trout have also been observed using the fishpass.

Mitchell Creek - Mitchell Creek is located on Kupreanof Island and drains into Duncan Canal, approximately 10 miles west, southwest of Petersburg. There are a series of falls located 3.1 miles above tidewater, two of which will be modified for coho salmon passage. USFS crews worked on the first barrier this year and will shift their attention to the second barrier in 1992. Coho salmon bioenhancement is scheduled to begin in 1992 using indigenous adult salmon below the barriers. Eggs will be collected and incubated in the new isolation facility being constructed at Crystal Lake

Hatchery with USFS funds. Habitat above the barriers is expected to produce an additional 3,200 adult coho salmon annually, as well as an undetermined number of steelhead trout, which should invade the upper watershed on their own.

Anan Creek - FRED Division personnel, with logistical help from the USFS, Wrangell Ranger District, replaced all of the dam boards in the Anan Creek fishpass during the spring of 1991. Since pink salmon were successful in ascending the falls on their own in 1991, Commercial Fisheries Division staff left the fishpass closed. In response to a request by the Wrangell Advisory Committee and the SSRAA Board of Directors, FRED Division central Southeast and USFS personnel examined the possibility of removing a rock that might impede immigrating pink salmon in the first falls. After observing the rock in question, there is concern that removal of the rock may actually hinder fish passage. This issue will be discussed again in Wrangell this winter.

CHAPTER 10

PROGRAM ELEMENTS

Sport Fisheries Enhancement Program

The FRED Division's sport fisheries enhancement program is large and complex. The division works directly with the Sport Fish Division in planning and implementing sport fisheries enhancement projects. A portion, usually between one-third and one-half of the sport fisheries enhancement program, is funded by federal monies under the Federal Aid in Sport Fish Restoration Act (W-B). The remainder of the program is funded by state monies which are audited annually to assure the federal government that the state is indeed using its W-B monies for sport fisheries, as required.

The sport fisheries enhancement program is complex, involving coho, chinook, pink, and sockeye salmon, rainbow and steelhead trout, as well as Arctic grayling and Arctic char. Life stages involved in the lake- and stream-stocking programs include fry, fingerlings, presmolts, smolts, and postsmolts. This program involves 13 facilities with releases at over 50 locations for anadromous fisheries and at over 300 sites for landlocked fisheries. Review meetings and planning sessions are held with the Sport Fish Division, regional planning teams, and other interested parties to improve the program wherever possible. The FRED Division's intent is to keep this complex program as comprehensive and responsive as possible. There continues to be a solid and increasing public demand for additional sport-fishing opportunities across the state, and the vast number of anglers respond very well to an enhancement-produced sport-fishing opportunity.

Highlights of the 1991 sport fisheries enhancement program include:

- An estimated 60,000 Arctic grayling fry from the Clear Hatchery were planted in 6 Prince William Sound lakes to increase area sport-fishing opportunities.

- Big Lake Hatchery released 225,000 coho salmon smolts in Fish, Cottonwood, and Wasilla Creeks to enhance northern Cook Inlet sport fisheries, as well as 235,000 coho salmon fry in landlocked lakes to enhance interior Alaska sport fisheries.

- Over 89,000 angler days were generated by Fort Richardson Hatchery rainbow trout projects in Anchorage area lakes in 1990, and over 11,000 angler days were spent harvesting 10,223 rainbow trout in the Kepler Lakes complex near Palmer in 1990 (1991 data not yet available).

- The first production-sized lots of "all-female" and all-female-triploid rainbow trout were produced at the BDC.

- An estimated total of 4,571 hatchery-produced coho salmon returned to Crooked Creek in 1991. Of these, an estimated 1,655 were caught in the sport fishery.

- A creel survey of the chinook salmon sport harvest at the Ninilchik River was conducted by lower Cook Inlet FRED Division staff during the 1991 fishery. The first returns of 3-ocean chinook salmon from the initial smolt release from Fort Richardson Hatchery occurred in 1991. Data collected during the creel survey were used in-season by the area Sport Fish Division biologist to extend the sport fishery by emergency order for an additional 10 days. Returns from the hatchery chinook salmon smolt releases accounted for 1,492 fish (39%) in the 1991 harvest.

- The Halibut Cove Lagoon chinook salmon return of 3,000 fish was the second highest in the program's 13-year history. The sport harvest was estimated at 2,250 fish, while the commercial harvest interception was 750 fish (25%).

- Over 14,000 salmon returned to the Homer Spit sport fish enhancement project in 1991, representing the highest catch to date. Sport fishermen harvested approximately 3,500 chinook salmon from late May to early July, 500 pink salmon during July through early August, and 10,000 adult coho salmon from August into October. In addition, approximately 800 coho salmon (13%) were intercepted in the personal-use gillnet fishery.

- The fourth year of chinook salmon returns to Seldovia Bay occurred in 1991 with a total estimate of 1,570 fish. An estimated 1,250 of these fish were caught by sport fishermen and the remaining 320 chinook salmon (20%) were intercepted in the commercial sockeye salmon set-net fishery in Seldovia Bay. City officials and residents remain very enthusiastic about this project, as this developing fishery is attracting more tourist interest to Seldovia. City officials believe this project has been responsible for significantly increasing the harbor-related economy during May and June 1991 and brought in many nonresident fishermen.

- A total of 90 separate lakes was stocked with 3 different species of fish from Clear Hatchery in 1991.

- Fish released from the Clear, Fort Richardson, and Big Lake Hatcheries into waters of the Tanana Drainage have accounted for a harvest of approximately 65,000 rainbow trout, 15,000 landlocked coho salmon, 2,500 Arctic grayling, and 500 Arctic char in roadside fisheries near Fairbanks, Delta Junction, and Tok in 1990.

- In 1991 the portion of the overall sport harvest composed of FRED Division hatchery fish is expected to have increased to a level near 75% due to continued shortages of wild-stock fish in interior Alaskan waters. The 1991 sport fishery harvest of FRED Division hatchery fish is expected to slightly exceed the overall 1990 harvest of 83,000 fish.

- Over 20,000 anglers fished in waters of the Tanana Valley that are totally dependent upon fish from the Clear, Fort Richardson, and Big Lake Hatcheries in 1990. These 20,000 sport fishermen spent nearly 90,000 days fishing for hatchery-produced fish during 1990, representing almost 50% of the sport-fishing effort that took place in interior Alaska that year.

- The 1991 sport effort of FRED Division hatchery-produced fish in interior Alaska is expected to be around 100,000 angler days. In 1991 the portion of the overall sport-fishing effort in interior Alaska dependent upon FRED Division hatchery-produced fish is expected to have increased to over 65% because of regulatory closures of several recreational fisheries due to wild stock conservation concerns.

- In 1991 sport fishermen caught 1,300 fish (primarily in the roadside fishery) which were produced from the Pavlof River coho salmon project at Snettisham Hatchery. This represents an outstanding 8% return to the sport fish creel. Harvest timing was in July and early August, as desired. There was a very strong interest in these fish, as evidenced by harvest as well as level of effort at the return site.

- Juneau anglers caught a record 5,000 Snettisham Hatchery chinook salmon from the popular Twin Lakes sport fishery. Well over 1,000 anglers participated in the fishery. This project is a cooperative project with the Sport Fish Division and funded by W-B monies.

- The triploid rainbow trout program initiated at Deer Mountain Hatchery in 1991 will provide a new tool for southeast Alaska sport fish enhancement. The triploid rainbow trout may be planted in more locations because there is no danger that these sterile fish will harm the genetic integrity of the wild fish.

- Steelhead trout at Deer Mountain Hatchery were successfully reared in salt water for a month prior to release. This is the first time this strategy has been used in Alaska to enhance the survival of steelhead trout.

Commercial Fisheries Enhancement Program

The 1991 Alaskan salmon harvest reached an all-time record of over 157 million fish.

Commercial fishermen benefited throughout the state from returns of hatchery-produced fish. Sockeye, chum, and pink salmon are primarily released for the commercial fisheries enhancement program.

FRED Division highlights from the 1991 commercial fisheries enhancement program include:

- The most dramatic southeast Alaska success story for sockeye salmon enhancement continues to be McDonald Lake. The production from lake fertilization (in addition to what would have been produced without fertilization) contributed 69,500 sockeye salmon to southern Southeast commercial fisheries, or 6% of the entire seine and gillnet commercial sockeye salmon catch for the Southern Southeast Region. Approximately 5,000 McDonald Lake sockeye salmon were harvested by subsistence users, and 176,200 escaped to the lake to begin another cycle.

- For the third year in a row, sockeye salmon from Snettisham Hatchery were planted in various transboundary rivers. This project marks the first production-scale use of the mass-marking technique of thermal tagging. Success of this program has been so

evident to international scientists that the program has been expanded to Tuya Lake, which might eventually be stocked with as many as 15 million fry.

- A record 485,000 hatchery-produced sockeye salmon adults returned to Main Bay Hatchery; of these, approximately 480,000 were caught in the commercial fishery.

- The 1991 Gulkana I sockeye salmon egg take of 36.05 million eggs is the largest sockeye salmon egg take in the world using modern egg-take methods.

- The 1991 total return to the Leisure Lake sockeye salmon stocking and fertilization project was estimated at 101,000 sockeye salmon. The commercial harvest of 96,000 fish comprised 29% of the lower Cook Inlet sockeye salmon harvest. Personal-use dip-net fishermen and sport fishermen harvested another 5,000 sockeye salmon.

- The commercial harvest of 200,000 pink salmon from Tutka Bay and Lagoon and from the Halibut Cove Lagoon remote rearing and release site accounted for 84% of the Southern District and 25% of the entire lower Cook Inlet commercial pink salmon harvest.

- The commercial harvest of Chenik Lake sockeye salmon totaled 60,400 fish, which was 18% of the entire lower Cook Inlet sockeye salmon harvest.

- Sockeye salmon returns to all enhancement sites contributed nearly 70% to the entire lower Cook Inlet commercial harvest for that species in 1991.

- Post-fertilization studies were continued at Karluk Lake. Survey results indicate abundant levels of zooplankton, a migration of 4.7 million high-quality smolts, and adequate escapement levels. The Karluk Lake sockeye salmon run is now restored.

- The significant return of over 75,000 chum salmon to the Kitoi Bay Hatchery allowed the hatchery staff to take a record 25.2 million eggs.

- This was the third consecutive year that the Frazer Lake sockeye salmon commercial catch was over 800,000. This year's catch was a record 1,494,600. Frazer Lake, a barren system for salmon until it was stocked in the 1950s, is the most successful sockeye salmon introduction in North America.

- Reconnaissance and area surveys were conducted in 1991 in the Chevak and Nelson Island portion of western Alaska to identify and locate potential fisheries enhancement opportunities. Physical, biological, and chemical data were collected on several area streams. Promising sites were identified and are currently being analyzed.

- The June 1991 fry release of 7,365,000 was a new record for Sikusuilaq Springs Hatchery, as was the 1991 egg take of 10.8 million chum salmon eggs.

Oil Spill Operations

On 24 March 1989 the *Exxon Valdez* went aground on Bligh Reef in eastern Prince William Sound. Approximately 11 million gallons of north slope crude oil poured out of the ruptured vessel to create the largest oil spill in North America. The downcurrent drift of this oil spill covered the highly productive nearshore waters and shorelines of Prince William Sound, Gulf of Alaska, western Cook Inlet, Kodiak Archipelago, Shelikof Straits, and Alaska Peninsula. Some FRED Division facilities were directly impacted by this floating oil. Area biologists and hatchery managers in Prince William Sound, Kodiak, and lower Cook Inlet and their respective staffs were immediately involved in protecting fish from oil impacts and evaluating impacts of the oil spill to determine how it might affect the natural habitat, commercial and private facilities, and activities.

In the time since the oil spill, FRED Division biologists have become partners in a multifaceted, multiagency scientific oil spill impact assessment team. Talents and resources were immediately pooled to plan and implement field studies to assess and document impacts of the oil spill. FRED Division involvement with oil spill impact assessment programs are continuing as part of the joint state-federal cooperative-assessment effort. The FRED Division has had a lead responsibility for projects within the package of approved projects.

Given the status of the proposed settlement, the FRED Division has been working with the Commercial Fisheries and Sport Fish Divisions to provide the fish and expertise to restore fresh water and marine fish habitat, as well as the fish populations impacted by the floating oil. During 1991 oil spill impact assessment studies have been continued, and FRED Division biologists initiated a project to begin fisheries-restoration efforts. Locations within Prince William Sound, lower Cook Inlet, and the Kodiak area were surveyed to evaluate and monitor their characteristics for potential projects to restore or enhance fish populations and fish habitat. Proposals have been prepared and are under discussion and review within the FRED Division, among the ADF&G fisheries divisions, and the Oil Spill Impact Assessment and Rehabilitation (OSIAR) Division. During and beyond fiscal year (FY) 1992, the FRED Division will be making substantial contributions to the restoration and enhancement of fisheries in the affected areas.

Economics Program

Salmonid fisheries enhancement for commercial fishery markets and subsistence and recreational users has had a variety of effects on Alaska's economy. Since state, federal, and private funds are invested into hundreds of individual salmon enhancement projects, and since the state's salmon resource is common property in nature, it is important for planners and policymakers to understand the resulting economic viability and employment potential of these programs.

The FRED Division Economics Program provides economic information to fishery interest groups, PNP hatchery operators, regional aquaculture associations, regional planning teams, and managers and policymakers in ADF&G, DCED, and the Alaska State Legislature on the consequences of ocean ranching, freshwater and saltwater recreation, and other proposed shellfish-enhancement activities.

Alaska's fisheries enhancement program has been the subject of a variety of studies designed to determine the economic effects of the program. These studies have been undertaken or contracted by the division's economist and, in 1991, by the Alaska State Legislature.

***Results of Employment Impact Surveys and Models*:**

Fishing industry expenditures on boat, gear, fishing electronics, processing, and direct income to harvesting labor and processing labor produce direct and indirect employment and income impacts to the Alaskan economy. These employment and income impacts have been projected for the statewide enhancement program since 1987 using an economic base model developed for the FRED Division by the Institute of Social and Economic Research (ISER). The most recent revision of these projected impacts was carried out for projected releases from 1991. The harvests from these enhanced releases will be included in commercial fishing harvests from 1992 through 1995. The employment from the statewide and PNP enhancement programs is projected to sustain over 3,500 jobs in the Alaskan economy (Table 10.1).

Table 10.1. Projected employment and income from the statewide enhancement program: impacts are projected for returning adults from 1991 releases.

	State	PNP	Total
Personal Income	$36 million	$66 million	$102 million
Resident employment	1,114 job	2,450 jobs	3,564 jobs

Notes: (1) Personal income numbers do not include income created by the recreational fisheries; and (2) state-owned enhancement projects contracted to PNP operators in the latter part of 1991 are included in the state personal income and employment numbers.

***FRED Division Economics Program Highlights*:**

- Assisted the Senate Committee on Domestic and International Fisheries in the most extensive cost-benefit analysis of the statewide fisheries enhancement program since the inception of the program in 1971. Assistance included: (1) Development of a detailed proposal for estimating the net benefits of state and PNP enhancement projects; (2) recommendation of principal investigators; (3) development of language for a request for proposals; (4) survey-design input for state and PNP hatchery production; and (5) financial information. The contracts for the economic studies are to be completed in FY 93. Previous estimates for the Governor's Mini-Cabinet on Fisheries determined that the enhancement program will ultimately generate net state benefits of $90.0 million for the commercial fisheries portion of the program (in 1984 dollars). This results in an overall benefit-cost ratio of 1.4:1. This means that $1.40 in fish values will be generated for each $1.00 expended, measuring all benefits and costs in dollars of equal value and discounting them as required to take into account

the time at which they occur. Detailed cost-benefit studies of new and expanded projects in the state's fisheries enhancement program suggest that the net benefits of the investments made since 1971 may be higher than previously anticipated.

- Completed a cost-benefit analysis for the proposed expansion of the Sikusuilaq Springs Hatchery for incorporation into the hatchery's operational plan. The analysis projected that the facility would not break even without a production level of 120 million chum salmon eggs. The 60 million-egg production level would only break even if construction costs were subsidized with federal funds.

- Prepared a financial analysis of state enhancement facilities proposed for contracting to regional aquaculture associations in FY 91, comparing long-term costs and revenues to fishermen, the State of Alaska, and regional aquaculture associations for the FRED Division director.

- Submitted and revised economic proposals for the *Exxon Valdez* oil spill-restoration plan.

- Provided assistance to the Prince William Sound/Copper River Regional Planning Team, the Southeast Allocation Task Force, and the Restoration Planning Work Group on economic issues.

Strategic Planning and Public Participation

During 1991 the FRED Division continued working on a strategic plan that will be submitted to the commissioner for consideration early during the legislative session. This planning process was initiated because of external influences on the program that necessitated change. After assessing social, political, economic, and traditional considerations, the division, having analyzed its strengths and weaknesses, realized it must maintain some of its current programs, transfer to the PNP sector others previously supported with general funds, and diversify by growing selectively into new areas. This strategic plan presents the division's direction for the 1990s and identifies the division's (1) statutory authorizations, (2) mission, (3) core program elements, (4) issues relative to program elements and roles supporting these efforts, (5) descriptions of primary disciplines within the division, (6) descriptions of regional programs, and (7) history.

As a result of this planning process, the FRED Division will focus its efforts and direct fiscal resources toward accomplishing specific program elements. The cornerstones of the division's program have been identified in the document as core program elements designed to guide current and future program directions. These elements include:

- Support and facilitate private-sector aquaculture programs.

- Provide essential technical services for departmental commercial, sport, and subsistence fisheries programs.

- Restore and enhance fish habitats.

- Provide technological support for economic development in aquaculture.
- Restore depleted wild fish stocks.
- Produce fish for departmental sport and subsistence fisheries programs.

The FRED Division recognizes the importance of keeping the Alaskan aquaculture community and general public aware of programs its conducting. The division has strengthened a program that commits to improving the methods by which the public becomes involved in project and program planning.

Public Participation and Education

Tours of hatcheries and presentations by FRED Division personnel continue to play an integral role in educating the public on fisheries enhancement. Hundreds of thousands of school children, other state residents, and tourists walked through FRED Division hatcheries in 1991. Student work programs were continued in state hatcheries. Division personnel gave many presentations to public groups, ranging from civic clubs to kindergarten classes. Many hatchery activities are covered by the media: FRED Division personnel are interviewed by newspaper, radio, and TV reporters.

The following are highlights of FRED Division public involvement in 1991:

- Interacting with tourists is an important role for Deer Mountain Hatchery staff, as an estimated 195,000 visitors toured the facility during the summer of 1991.
- Deer Mountain Hatchery continues to be the primary place in Ketchikan where local Community Service Workers can work off their fines. In 1991 Community Service Workers worked approximately 2,000 hours at the hatchery.
- A new facet of the steelhead trout program at Klawock Hatchery was planting 1,000, 225-g, 2-year-old steelhead trout in a landlocked lake (One Duck Lake) for a Kids' Fishing Derby during National Fishing Week. The derby drew 300 local children for a day of fishing and learning how to fish. The USFS and Sport Fish Division cooperated with the FRED Division to make this a highly successful event. Local residents continued to fish in the lake throughout the year.
- City of Klawock Summer Youth Interns, volunteers, and FRED Division personnel cooperated in developing access along Bennet Creek. Site preparation and breaching the beaver dam were included in this public-participation project.
- Rural Student Vocational Program students assisted with work at Snettisham Hatchery, the Coded-Wire Tag Processing Laboratory, and the Juneau Pathology Laboratory. This program places students from rural areas into a 2-week vocational setting in the students' field of interest.
- FRED Division staff worked with the Sport Fish Division on a project involving two classes of fifth-grade students in Juneau. A newly built aquatic education-boardwalk

trail along Switzer Creek was the setting for field trips with the children. A map of a silted pool was created from measurements taken with a class group. The map will help in the development of a restoration plan for this reach of the stream.

- The FRED Division has participated in the Anchorage SKIF (Streams KIds and Fish) Committee that proposed the development of an integrated, multi-disciplined approach to habitat restoration, fisheries enhancement, and educating school children about fish and the environment. Members include ADF&G, the Municipality of Anchorage Assembly, the Anchorage School District, and the Municipality's Department of Health and Human Services.

- With public participation, a waterflow-control structure was installed in Campbell Creek Park to divert the main channel of the stream away from a Municipal Park picnic area. Flow was controlled, siltation reduced, rip rap placed along the previously eroding bank, and boulders installed to develop resting areas for fish.

- The "Streamwalk" program was implemented in Anchorage and statewide with methods from the Environmental Protection Agency to follow water-quality trends in waterways. The program has been implemented under a cooperative effort with the FRED and Sport Fish Divisions and Department of Environmental Conservation (DEC). Schools will supply most of the Anchorage "streamwalkers."

- Classrooms and libraries in schools in a variety of locations in Alaska have begun classroom-incubation projects to learn, through involvement, about fish life history and habitat needs. FRED Division assistance is being provided in such places as Prince of Wales Island, Ketchikan, Big Lake, Tok, North Pole, Anchorage, Palmer, Wasilla, Nome, lower Yukon, Unalakleet, and Shaktoolik. FRED Division staff also provide technical assistance to schools and provide presentations.

- The Nome-Beltz High School Fisheries Program, a cooperative program between the high school, Bureau of Land Management, and FRED Division, has attracted national attention through the Washington, D.C.-based Times Mirror Conservation Council.

- All carcasses from the 1991 egg take and excess male salmon at Sikusuilaq Springs Hatchery were given away to local dogmushers and subsistence users.

- Sikusuilaq Springs Hatchery continued to operate with a complete open-door policy. People are welcome to come in at any time of the day or night year round. The hatchery serves as an important "outpost" that provides a base for area searches, a warmup facility for cold travellers, and a place to stay when travel is difficult.

- The Villages of English Bay and Port Graham, supported by The North Pacific Rim Corporation, have also cooperated in several area projects, including English Bay sockeye salmon rehabilitation and Port Graham Bay pink salmon enhancement. Significant sockeye salmon rehabilitation work was conducted at English Bay in 1991.

- The FRED Division worked with volunteers from the South Peninsula Sportsman's Association and Homer Charter Boat Association short-term rearing pink salmon fry as well as coho and chinook salmon smolts on the Homer Spit.

Engineering Services

Engineering services provided by FRED Division staff consisted of coordinating various activities, including environmental studies, materials computations, contract administration, consultant coordination, financial management, outside-agency coordination, public involvement, and coordination with PNP operators on various projects. Other engineering services included drafting for other divisions, final design plans and specifications, cost estimates, and obtaining environmental permits for projects.

Engineering and drafting services were provided to the Snettisham, Crystal Lake, Big Lake, Trail Lakes, Cannery Creek, Tutka Bay, Pillar Creek, Kitoi Bay, Fort Richardson, and Elmendorf Hatcheries, as well as Lake Lucille Dam, the Glennallen Regional Office, Big Boulder Creek, Creamer's Dairy, Creamer's Field, Sand Point, Campbell Creek, the Commercial Fisheries and Wildlife Conservation Divisions, and PWSAC.

CHAPTER 11

TECHNOLOGY AND DEVELOPMENT

This year has been punctuated by several milestones. First and foremost, Dr. Jeffery Koenings, formerly principal limnologist for the division, was named director. Replacing Jeff in Soldotna is Dr. Dana Schmidt. Dana was formerly with the Commercial Fisheries Division and worked out of Kodiak.

Division pathologists have found a second occurrence of viral hemorrhagic septicemia (VHS) in Pacific cod. This is extremely important work, since it was this virus that prompted the destruction of several million salmon smolts in Washington State hatcheries in 1989. Our Southcentral Pathology Laboratory is initiating studies to investigate the virulence of this disease agent on various species of salmonids.

The Mark/Tag Processing Laboratory has set yet another record for volume of work processed in a single year. The poor working conditions at the lab are still with us, and will not be solved until this laboratory is relocated into a different building. As has been the case for years, the FRED Division has once again requested capital improvement funds to acquire a new home for this laboratory.

Other important events include (1) the launching of a review of the department's fish genetics policy, (2) involvement with the Legislature's "Hatchery Review Project," (3) hosting three visiting Soviet scientists for a week-long workshop on sockeye salmon, and (4) responding to requests to generate and/or review oil spill restoration proposals. Outside the state, we are very much involved in restoration of Snake River sockeye salmon and Cedar River-Lake Washington sockeye salmon. We have also been working as members of the Pacific Northwest Fish Health Protection Committee (PNFHPC) in its efforts to understand and minimize the impact of new federal regulations on therapeutants used in the aquaculture industry.

Coded-Wire Tag Processing Laboratory

1991 Operations:

In 1982 the Coded-Wire Tag Processing Laboratory moved from Sitka to the Subport Building in Juneau. In that first summer, a staff of 7 processed 13,000 heads. In the same facility, a staff of 21 processed over 76,000 heads in 1991. In these 10 years, laboratory procedures have been streamlined and the lab and its staff have become very efficient. This season the lab employed as many technicians as there were work stations. The short salmon season and the need for inseason hatchery contribution estimates require that the lab employ a large number of seasonal staff for a relatively short period of time. If the number of samples staff must process continues to increase, they will no longer be able to provide the required level of service within the confines of its existing facility. During the peak fishing season in 1990, 8 seasonal technicians processed an average of 3,330 heads per week. In 1991, 10 technicians processed 4,240 heads per week. Over 5,800 heads were processed in

two separate weeks. Without a motivated staff and dedicated supervisors, the lab would not have been able to process these record numbers. Efforts to secure a larger and safer working environment for this project continue.

Although the majority of work continues to be generated by sampling programs in southeast Alaska, this year the large sampling project in Prince William Sound generated 34% of the total work. The species and sample-source composition of the workload are presented in Table 11.1 below.

Table 11.1. Coded-Wire Tag Processing Laboratory sample-source composition by species.

	Commercial	Cost recovery	Sport	Rack and escapement	Other	Juvenile	Total
Chinook	10,143	1,122	1,250	1,653	19	1	14,188
Chum	961	97	2	506	42	27	1,635
Coho	25,413	2,438	2,811	3,467	19	135	34,283
Pink	6,727	3,187	0	4,623	663	1,611	16,811
Sockeye	6,227	23	4	2,769	10	0	9,033
Steelhead	66	0	3	0	0	0	69
TOTAL	49,537	6,867	4,070	13,018	753	1,774	76,019

The Tag Lab's work output is easily measured by the number of tags and samples processed; however, success is measured by the quality and utility of the data generated and maintained. Tag Lab clients now rely on the availability and dependability of the coded-wire tag database. The lab's ability to keep up with the increased volume of work and increased pressures from lab user groups has been achieved because of the information system developed and enhanced over the years. In 1982 technicians wrote deciphered tag codes on forms, and another person keypunched sample and tag-code information onto computer diskette. At night, data were transferred over a modem to an off-site mainframe computer. In 1982 a limited number of reports were available. If these reports did not suit a user's need, the user would have to summarize and tabulate the data by hand.

Today, however, data-entry staff interactively enter sample information onto the lab's minicomputer while technicians decode tags and enter the deciphered codes directly onto the database. Results are immediately available. Now, in addition to standard reports, the lab generates hundreds of special-purpose reports to answer managers and researchers' data inquiries. On-line access to the database is provided to the lab's users. The lab is no longer limited to generating hard-copy reports. Today, staff generate reports on a variety of magnetic media and also transfer data to users on ADF&G's wide-area network. Computers have allowed lab staff to become more efficient and more responsive. One of the few aspects of the lab's operation that cannot be assisted by computers, the dissection of a tag from a head, is the bottleneck of the entire process. A challenge in the future will be to continue to become more efficient and to provide managers and researchers with greater accessibility to the coded-wire tag database.

Genetics

A major part of the FRED Division's genetics function in 1991 was administration of the state's genetic policy. This encompassed many activities, including the review of FTP applications, review of hatchery permit alteration requests, participation in regional planning team meetings, and reviewing breeding plans for some existing hatcheries and proposed stock enhancement projects. A review of the genetic policy was initiated at a meeting in July by establishing a 10-member agency/industry review team; comments are still coming in on suggested revisions, and there are plans to hold a second meeting early in 1992.

Two of the more crucial breeding plans worked on were those of the proposed restoration of the depleted chinook salmon stocks of the Chilkat River drainage and proposed expansion of chum salmon production at the Sikusuilaq Springs Hatchery on the Noatak River. The Chilkat River plan was important because of the serious decline of the wild stock(s) in recent years; our plan includes a close examination of stock structure of putative tributary populations using data from allozymes and DNA, provisions to minimize inbreeding in proposed supplemental production, and provisions for gene banking. The Sikusuilaq Springs Hatchery plan was important because of grave concerns for wild-stock protection in the face of the proposed increased hatchery production. Genetics staff worked closely with biologists from other divisions, biologists from the National Park Service, and members from the local communities to incorporate genetic safeguards and risk assessment into the hatchery-expansion plan.

Genetics Research:

In 1991 the genetics research program expanded to include diverse elements, such as evaluation of the use of sterile stocks for some enhancement/mariculture activities, sperm cryopreservation, genetic toxicology, and genetic-stock identification.

Sterile Fish and Shellfish:

Staff are conducting research to evaluate the utility of genomic manipulations, primarily for the possible enrichment of sport fishing and mariculture opportunities. The focus is on the performance, reproductive biology, and behavior of fish sterilized by induced triploidy. Research in the ADF&G Genetics Lab and others has shown that triploid fish and shellfish do not normally reproduce: Populations of such fish, if completely sterile, may be used for stocking in areas where reproduction is not wanted, and sterile fish offer a better return to the creel than do fertile fish, which sacrifice metabolic growth for reproduction (and sometimes death).

BDC:

The BDC at Fort Richardson Hatchery continues to perform state-of-the-art research on the production of all-female diploid, all-female triploid, and mixed-sex triploid rainbow trout for stocking into landlocked lakes. Early this year, FRED Division staff participated in a review of the selective breeding program at the BDC, and determined that those activities could be better redirected into the more successful all-female and sterile-fish program.

Deer Mountain Hatchery:

Staff at the Deer Mountain Hatchery agreed to host triploid coho salmon and chinook salmon research. Eight replicates of an experiment were conducted to look at hatchery performance, and staff are working on sperm cryopreservation techniques to help provide a mechanism for reintroducing genetic variation from wild stocks into hatchery stocks.

Development of Candidate Scallop Species for Mariculture:

Scallop culture is widely regarded as having enormous commercial potential in Alaska. Hatchery-culture techniques have been developed for some species in other regions around the Pacific Rim: In China, 120,000 MT of *Argopecten irradians* were cultured in 1988; in Japan, the Japanese scallop, *Patinopecten yessoensis*, has been cultured since the 1950s; and British Columbia, Canada, has a nascent industry for Japanese scallops. Here in Alaska, where strict regulation prohibits the importation of exotic species for aquaculture, the most logical candidate for industry is the native weathervane scallop, *Patinopecten caurinus*. But all attempts to rear weathervanes in the hatchery environment have failed.

In 1991 genetics staff embarked on a technology search to attempt to find a solution to this obstacle. Two possibilities considered were (1) the triploid sterilization of the Japanese scallop, removing genetic objections to its possible importation; and (2) identification of advanced hatchery techniques to solve the biological block to successful weathervane culture. A proposal has been made to the Alaska Science and Technology Foundation to address improvements to both possible approaches.

Sperm Cryopreservation:

The department's sperm-banking research is funded, in part, by a grant from the U.S. Department of Agriculture (USDA). Staff are freezing chinook and coho salmon sperm at the BDC and Deer Mountain Hatchery for later use in genetic studies. The thrust of the USDA-funded research is hatchery performance of triploids and gene mapping; the banking of sperm will allow staff to make repeated use of experimental males of known genotype for a number of generations. However, an immediate payoff from use of this technology is that genetic diversity of depleted stocks could possibly be preserved. Sperm is already beging frozen as a part of the Chilkat River chinook salmon restoration project. The stock is severely depleted, and staff are storing genetic variation for possible later reintroduction. This year 2 Chilkat-stock females returned to the Pullen Creek egg-take site at a time when no males were present (males were luckily found before the eggs were lost). Next year we will be prepared to use cryopreserved sperm, should this event happen again.

Genetic Stock Identification (GSI):

The division's GSI research this year has largely been limited to proposal submission and sample collection. Preliminary approvals have been obtained for the funding of a study of the population genetics of stocks affected by the *Exxon Valdez* oil spill. Commercial Fisheries Division staff in Cordova donated a huge amount of effort this summer collecting samples from pink and chum salmon populations for this study. Plans also include working with Sport Fish Division staff on a genetic study of affected populations of cutthroat trout and Dolly Varden char in Prince William Sound.

Also, the National Park Service cosponsored sample collection from spawning aggregates of chum salmon on the Noatak and Kobuk Rivers. These tissues will be examined to provide information to safeguard the wild stocks during the proposed Sikusuilaq Springs Hatchery expansion.

Limnology and Lake Fertilization

Limnology Laboratory - Soldotna:

The Limnology Laboratory supports the FRED Division's lake enrichment and lake stocking programs and participates in cooperative projects with federal and state agencies, universities, and PNP aquaculture/fishermen associations (Table 11.2). The division has a centralized water-quality laboratory in Soldotna where both water quality and biological (zooplankton and fish) samples are analyzed from statewide projects.

During 1991 the Limnology Laboratory conducted nearly 34,000 individual water quality and zooplankton analyses (Table 11.3) on samples collected from over 90 lakes statewide as well as from Speel Arm estuary (Table 11.4). Samples were collected from Cook Inlet and the Kodiak area as part of the oil spill sockeye salmon overescapement studies and existing and potential lake enhancement projects. Limnological samples were received from lakes in Prince William Sound and southeast Alaska from ongoing (and potential) sockeye and coho salmon enhancement projects, and from Nome for potential instream-incubation sites. Turbidity and suspended solids analyses were also conducted in support of an investigation on the effects of current logging activities on water quality within the Big Kitoi Lake watershed. The Kenai River water-quality investigation, a multiagency cooperative project involving ADF&G, USF&WS, and ADNR, continued its second year of data collection and analysis with sampling emphasis within the lower river. Cooperative agreements were established with the National Park Service for baseline water quality of Tanada and Copper Lakes within the Wrangell-St. Elias National Park and Preserve, and with the Kenai National Wildlife Refuge (KNWR) as part of both a wetlands classification and wood frog habitat study, respectively. Finally, contracts were established with the University of Alaska-Anchorage, the Chignik Regional Aquaculture Association, CIAA, KRAA, SSRAA, NSRAA, USFS, and Aleutians East Borough for assessments of water quality, lake productivity, or evaluation of enhancement projects.

Limnological samples collected during 1991 are currently being processed on a priority basis, and data-summary reports are being disseminated to project personnel upon completion of analyses. Quality assurance of analytical results was maintained through continued participation in the U.S. Geological Survey Standard Reference Water Sample Program.

Otolith Research:

The Limnology Laboratory initiated new research involving the use of juvenile salmon otoliths to analyze growth patterns and identify hatchery fish from wild fish utilizing a BioSonics Image Analysis System. A majority of the otolith work is being conducted as part of an oil spill assessment project on pink salmon fry. This project focuses primarily on the

Table 11.2. List of government and private agencies either contracting or requesting analytical services of the Limnology Laboratory during 1991.

Alaska Department of Fish and Game

Commercial Fisheries Division
Big Lake Hatchery
Crooked Creek Hatchery
Elmendorf Hatchery
Pillar Creek Incubation
Snettisham Hatchery

PNP Groups

Chignik Regional Aquaculture Association
Cook Inlet Aquaculture Association
Kodiak Regional Aquaculture Association
Lower Cook Inlet Seiners' Association
Northern Southeast Regional Aquaculture Association
Southern Southeast Regional Aquaculture Association

Federal Government Agencies

National Marine Fisheries Association
National Park Service - Wrangell St. Elias National Park
U.S. Fish and Wildlife Service, Kenai National Wildlife Refuge
U.S. Forest Service
U.S./Canada Pacific Salmon Treaty

Other

Department of Natural Resources
University of Alaska

Table 11.3. Number of samples and total number of analyses conducted per test by the Limnology Laboratory during 1991.

Parameter	Number of samples	Number of replicates	Total number of analyses
Conductivity	1,221	--	1,221
Ph	1,221	--	1,221
Alkalinity	1,217	--	1,217
Turbidity	1,294	--	1,294
Color	1,429	--	1,429
Calcium	1,076	--	1,076
Magnesium	1,076	--	1,076
Iron	1,252	x2	2,504
TP/TFP	2,498	x2	4,996
FRP	1,176	x2	2,352
TKN	1,221	x2	2,442
Ammonia	1,161	x2	2,322
Nitrate/nitrite	1,220	x2	2,440
Reactive silicon	1,181	x2	2,362
Carbon	1,061	--	1,061
Chlorophyll	1,389	--	1,389
Zooplankton	600	x3	1,800
Otoliths	1,500	--	1,500
TOTAL	22,793		33,602

Table 11.4. List of study lakes by geographic region from which water-quality samples were received by the Limnology Laboratory during 1991.

Cook Inlet	Kodiak	Prince William Sound	Northern Southeast	Southern Southeast
Bear	Afognak	Coghill	Auke	Badger
Big Lake Hatchery	Akalura	Crosswind	Chilkat	Bakewell
Bruin	Barbara	Eshamy	Chilkoot	Big Ratz
Chelatna	Becharof	Esther Pass	Crater	Hugh Smith
Chenik	Big Kitoi	Eyak	Crescent	McDonald
Crooked Creek Hatchery	Black	Pass	Deer	Neck
Elmendorf Hatchery	Charlie Hanson	Paxson	Farragut	Salmon
English Bay	Chignik	Summit	Redoubt	Ward
Hazel	Crescent		Speel	Virginia
Hidden	Dry Spruce		Speel Arm	
Kenai River	Frazer		Sweetheart	
Kenai	Goat			
Kirschner	Hidden			
Leisure	Horse Marine			
Packers	Karluk			
Paint	Laura			
Port Dick	Little River			
Skilak	Malina			
Tustumena	Mortensens			
Ursus	Mush			
	Olga			
	Orzenoi			
	Portage			
	Red			
	Red Bluff			
	Red Cove			
	Spiridon			
	Thin Point			
	Thorshime			
	Uganik			
	Upper Station			

marine zone of juvenile pink salmon otoliths in an attempt to isolate and characterize patterns of early marine growth. Other work involves determining the feasibility of using otoliths to separate wild and hatchery sockeye salmon fry. Upon completion of initial studies, the lab will have prepared over 1,500 otoliths for image analysis. Further research will be directed in the use of otolith pattern-recognition technology as an alternative method for hatchery-stock identification. Finally, the laboratory hosted an otolith workshop for biologists interested in utilizing otoliths for various research on juvenile salmonids.

Field Projects - Southcentral:

Applied limnological and fisheries field research in the southcentral region was conducted on 8 lakes in Prince William Sound, 9 lakes in lower Cook Inlet, 8 lakes in upper Cook Inlet, and 31 lakes on Kodiak and Afognak Islands. This work includes assessment of potential in-lake production of sockeye salmon, evaluation of nutrient enrichment and stocking projects, and water-quality monitoring. Assessment of active stocking and lake fertilization projects included monthly sampling of each lake, and conducting one fall hydroacoustic/tow-net survey on 10 lakes in Cook Inlet and 8 lakes in the Kodiak area.

In 1991 the Kenai River water-quality project duplicated sampling that was conducted during 1990 to establish a baseline of data for monitoring and gauging changes in water quality in the future. However, during 1991 supplementary sampling was conducted within the lower portion of the river where some water-quality parameters were observed higher in 1990. In addition, a more intensive sampling of macroinvertebrates was conducted and fish samples collected for metal concentrations and accumulated hydrocarbon residuals.

In the Southcentral Region, a total of 150 tons of fertilizer was applied to 7 different lakes. Lakes treated with fertilizer in 1991 included Frazer, Afognak, and Malina Lakes in the Kodiak area, Chenik, Packers, and Leisure Lakes in the Cook Inlet area and, finally, Bear Lake located near Seward.

From nutrient enrichment and stocking projects in lower Cook Inlet, a record harvest of over 223,000 (67% of the total harvest) sockeye salmon was produced in 1991. A total of 16,000 sockeye salmon was harvested in lower Cook Inlet and sold by commercial fishermen (Cook Inlet Seiners' Association) to cover the cost of the lower Cook Inlet sockeye salmon enhancement program. In 1991 a record escapement count of 44,899 sockeye salmon was recorded at Packers Lake. This lake has been treated with nutrients since 1983 and stocked with fingerlings since 1988. The high escapement in Packers Lake allowed CIAA (project cooperator) to cost recover 3,600 sockeye salmon. Finally, for the second consecutive year, sockeye salmon fingerlings released into Bear Lake under fertilized conditions have emigrated at large sizes as smolts and, most surprisingly, a portion of the released fingerlings emigrated from the lake after only 8-10 weeks of rearing (zero-check).

New projects include evaluation of 5 lakes near Cold Bay to assess the potential for sockeye salmon enhancement. Funding for this work was received from the Aleutians East Borough through a cooperative agreement. In addition, funding was received from the Chignik Regional Aquaculture Association for evaluating current sockeye salmon production of Chignik and Black Lakes. Other outside-funded projects include Cook Inlet lake investigations (CIAA), Kodiak lake investigations (KRAA), Kenai Peninsula aquatic habitat study (USF&WS), Wrangell-St. Elias lake inventory (National Park Service), Anchorage area

lake water quality (University of Alaska-Anchorage), Kenai River water-quality project (Alaska Department of Natural Resources [ADNR]), and the forthcoming Coghill Lake nutrient-enrichment project (USFS).

Field Projects - Southern Southeast:

Applied limnology and fisheries field research in southern Southeast was conducted on Badger, Bakewell, Big (Ratz Harbor), Eagle, Hugh Smith, Margaret, McDonald, Neck, Virginia, Ward, and Woodpecker Lakes during 1991 to evaluate juvenile sockeye salmon outplants and lake-enrichment projects. Sockeye salmon production potential of lakes under investigation by the USFS was also assessed, and a total of 24 limnological and 11 hydroacoustic/mid-water trawl surveys was completed.

Additional activities include the following at McDonald Lake: Preemergent fry sampling, transport and application of 62.5 tons of liquid fertilizer, assisting SSRAA with a sockeye salmon egg take, and 8 escapement surveys. In addition, a total of 13,122 sockeye salmon fry from the Beaver Falls CIF were coded-wire-tagged for the Margaret Lake bioenhancement project, and another 42,303 sockeye salmon fry were coded-wire-tagged from the Beaver Falls CIF for the Virginia Lake bioenhancement and fertilization project.

The 1991 preliminary production estimate of adult sockeye salmon from the McDonald Lake fertilization project is 251,983, of which the southern southeast Alaska commercial seine and drift gillnet fleets (including Annette Island) in Fishing Districts 101-108 caught 69,605. This represent 5.3% of the total sockeye salmon harvest in southern Southeast with an ex-vessel value of $352,570. In addition, subsistence users harvested 5,000 sockeye salmon, and the adult escapement into McDonald Lake was 174,910 sockeye salmon.

The Badger/Bakewell sockeye salmon fry-stocking project produced 18,936 adult sockeye salmon for the southern Southeast commercial fleets (including Annette Island), which had an ex-vessel value of $98,165. The harvest rate for this stock is extremely high (97.7)%. In addition, the Hugh Smith Lake sockeye salmon-stocking project produced 6,169 adult sockeye salmon for the southern Southeast commercial fleets (including Annette Island), which had an ex-vessel value of $32,329. The harvest rate for this stock was 51.2% in 1991. Additional evaluation of sockeye salmon juvenile outplants continues at Badger/Bakewell, Hugh Smith, Margaret, Salmon (Karta River), and Virginia Lakes.

The FRED Division Beaver Falls Hatchery operations was contracted to SSRAA in 1991. The remote egg takes and fry-stocking projects continued under a cooperative venture.

Finally, southern Southeast projects are conducted as cooperative ventures with funding primarily from the USFS, (Craig, Ketchikan, Misty Fiords, Thorne Bay, and Wrangell Ranger Districts), as well as SSRAA and the U.S./Canada Pacific Salmon Treaty.

The lake-enrichment program contributed 36,925 sockeye salmon to the Southeast subsistence harvest in 1991. This is 4,000 more fish than 1989 (Figure 11.1).

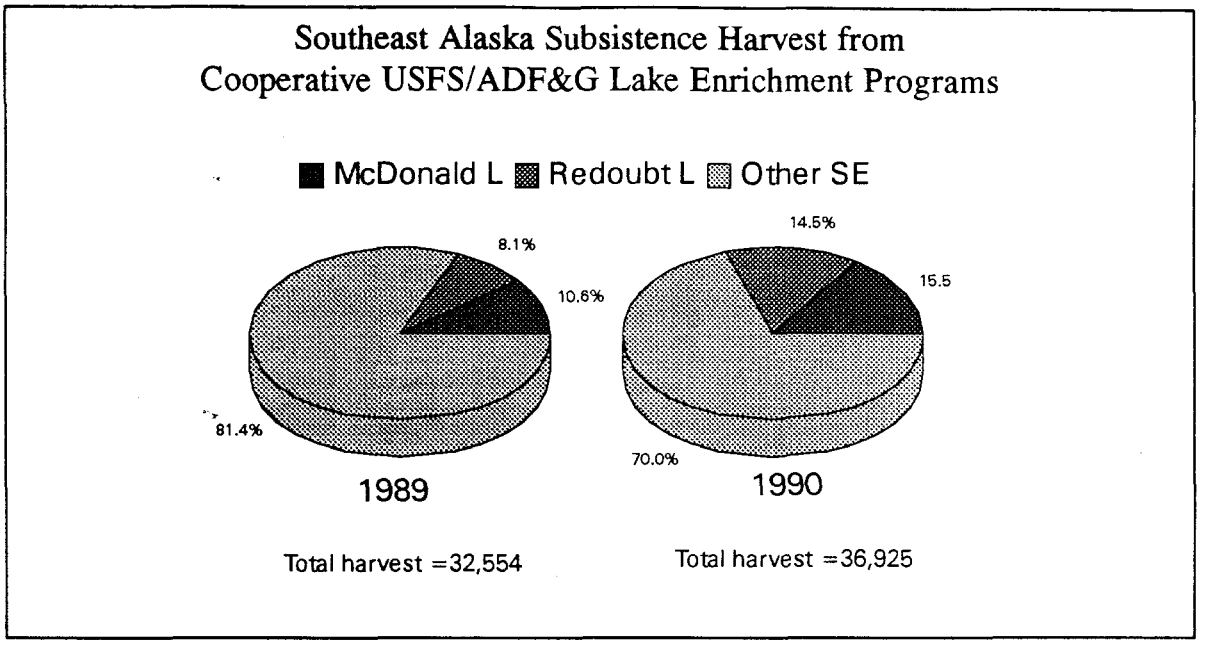

Figure 11.1.

***Field Projects - Northern Southeast*:**

Limnology and fisheries field research was conducted on 8 lakes and 1 estuary site in the northern Southeast area as a continuation of the FRED Division's sockeye salmon enhancement and research program. These projects were designed to (1) evaluate in-lake productivity using enhancement techniques of fry stocking and lake enrichment; (2) continue the sockeye salmon research rearing-capacity studies to identify rehabilitation, enhancement, or management options for increasing indigenous or artificial sockeye salmon populations; and (3) evaluate the nearshore productivity of the estuary near Snettisham Hatchery.

Redoubt and Deer Lakes continued to receive fertilizer additions during 1991. Both of these projects are conducted cooperatively with the FRED Division, USFS-Sitka Ranger District, and NSRAA.

Deer Lake is a barriered-lake system that prevents access to salmon, and lake fertilization is designed to increase zooplankton populations utilized by stocked coho salmon juveniles. The USFS has contracted with the FRED Division to determine nutrient loading, purchase fertilizer, and provide analysis of water and zooplankton samples.

The Redoubt Lake project involves rehabilitation of the indigenous sockeye salmon population by increasing lake productivity through nutrient enrichment. A USFS Sykes Act contract provides funding to purchase fertilizer for Redoubt Lake, sampling personnel, logistical support, and an in-lake egg-incubation project conducted by NSRAA. Limnology Section personnel are responsible for directing all operational aspects of this project and evaluating in-lake responses to the fertilizer applications. During 1991 the FRED Division operated a remote camp to enumerate the smolt emigration and adult escapement, conduct limnological surveys and spring and fall hydroacoustic/tow-net surveys, and determine and apply over 100 tons of liquid fertilizer.

Sweetheart and Crescent Lakes are the only projects in northern Southeast currently receiving plants of sockeye salmon juveniles from the Snettisham CIF. Sweetheart Lake received a

total of 2.4 million sockeye salmon fry (from the Speel Lake brood stock) in 1990 and 1.3 million fry in 1991. Limnological surveys were conducted at two stations on a monthly basis during June through November, hydroacoustic/tow-net surveys were conducted during the spring and fall to determine juvenile population estimates, and two smolt-enumeration locations were established on the lake outlet to ascertain outlet-induced mortality during emigration.

Crescent Lake received approximately 400,000 sockeye salmon fry (from the Crescent Lake brood stock) in 1990 and 69,000 presmolts in 1991. Field studies were undertaken to evaluate the in-lake productivity and survival of these stocked fry. An estuarine-productivity project was continued for the second field season to document the nearshore productivity of the estuary near Snettisham Hatchery. Field sampling was concentrated during the period when hatchery-produced fry and smolts would generally be scheduled for release into the nearshore marine environment (April-June). Vertical and horizontal zooplankton tows were conducted at 3 sites every two weeks between the first week of April and last week of June. Nutrient water chemistry and physical oceanographic data were collected monthly at the 3 established sampling sites.

Finally, a cooperative project involving the FRED and Commercial Fisheries Divisions and NSRAA was continued in 1991 at Chilkat and Chilkoot Lakes in the Haines area. This was the fifth and final year planned for this project.

Pathology

Hatchery Inspections:

A total of 26 facilities among the 48 statewide facilities was inspected by three FRED Division pathologists in 1991. Beginning in FY 91, hatchery inspections were placed on a rotational schedule in which approximately half are inspected annually. Consequently, each facility is inspected a minimum of once every other year. This is in compliance with the 1988 recommendations of the State Pathology Review Committee. All Alaskan hatcheries were rigorously inspected annually with subsequent recommendations for improvements made by FRED Division pathologists for the past 5 years. At many such facilities, there have been no significant disease problems and no major changes in management or physical plant from year to year. Hence, further benefit from continued yearly pathology inspections would not be significant, particularly with increasing travel costs and shrinking agency budgets. Should any hatchery develop a specific ongoing disease concern, yearly inspections can be done, if such would resolve the problem in a more timely manner.

Cases Processed and Tests Performed:

Cases processed totaled 178 that involved 19,217 fish and shellfish, with a total of 20,561 tests performed: 2,419 at the Anchorage Laboratory, 16,388 at the Juneau Laboratory, and 1,754 at both labs.

It should be noted that in addition to diagnostic duties, a significant portion of Anchorage staff responsibilities and time involves recordkeeping-support functions (typing, budget

tracking, disease-history database entry, fiscal reporting, etc.) for the entire FRED Division Pathology Program.

FTPs Reviewed:

A total of 189 FTPs was reviewed (Southeast-90; Southcentral-99) by pathology staff, with a total of 186 approved and 3 disapproved by the Pathology Section.

Statewide IHNV and VHSV Monitoring:

The statewide monitoring of IHNV in sockeye salmon brood stock was maintained at about the same level as in FY 90 (about 2,000 tests); however, the increase in virus assays to 4,794 was primarily due to examination of non-sockeye salmon species for VHSV. As yet, no VHSV has been detected in any Alaskan salmonid. Typically, IHNV accounted for very minor sockeye salmon fry losses this past year, with only 2.4 million fry (3.4% of total production) lost at 3 facilities (one lot of Packers Lake sockeye salmon at Trail Lakes Hatchery, one incubator of Speel Lake sockeye salmon at Snettisham Hatchery, and 4 incubators of Gulkana I sockeye salmon at Gulkana Hatchery).

The refocusing of IHNV-detection efforts on released smolts and ripe adult returns at Main Bay (PWSAC) and Beaver Falls (SSRAA) Hatcheries showed some interesting results. IHNV was detected in only one returning coded-wire-tagged male sockeye salmon at Main Bay Hatchery in 1990. The hatchery is on virus-free water and no virus has ever been detected in Main Bay fry or smolts. The presence of the virus in a sockeye salmon adult directly from salt water and known to have been released from the hatchery suggests that the carrier state for IHNV in sockeye salmon does exist. This year tagged returns were almost all positive for IHNV, probably a result of horizontal transmission from a few carrier sockeye salmon in the adult holding pond.

No IHNV was detected in the few SSRAA sockeye salmon returning to Beaver Falls Hatchery in 1990. More fish returned in 1991 with detection of IHNV in nearly all adults. The returns were comprised of fish from IHNV-negative parents and some from low-level IHNV-positive parents. No IHNV has ever been detected in the Beaver Falls fry or smolts. It is possible that either the IHNV family fish carried the virus or that fry were released with subclinical IHNV that could not be detected. In either case, probable carrier fish returned to the facility and likely transmitted the virus horizontally, causing a high prevalence of IHNV-positive fish, similar to the situation observed at Main Bay.

Enzyme-Linked Immunoabsorbent Assay (ELISA) Testing for the BKD Agent Antigen:

ELISA for detecting the antigen of the BKD agent (*Renibacterium salmoninarum*) has been used in the FRED Division's Juneau Fish Pathology Laboratory for four years and has proven to be a very sensitive and effective tool for brood stock screening and determination of the carrier state for this pathogen in resident salmonids within various hatchery water supplies. ELISA has largely taken the place of the fluorescent antibody test (FAT), which is now mostly used for diagnostic confirmation and occasional spot checks for ELISA using the higher-level positive fish. This past year 66 cases for ELISA were processed, amounting to 7,864 individual fish tested. Considerable data accumulated from this assay have been statistically analyzed for publication in the near future. The ELISA can detect about 20 ng

of BKD agent antigen/ml of kidney sample. ELISA has shown that FAT can only detect 27% of the positive fish, with another 26% being falsely positive due to unavoidable washover during the FAT procedure.

***Bitter Crab Disease Syndrome Studies*:**

The importance of bitter crab disease in Southeast and Bering Sea Tanner crabs has not diminished. Extensive distribution surveys involving participation of FRED Division Pathology Section staff, the Commercial Fisheries Division, and NMFS are in their fourth year of study for Southeast, as well as for the eastern and western Bering Sea, including Norton Sound and the Chukchi Sea. All work completed and currently being done has not been specifically funded. Despite this handicap, Commercial Fisheries Division shellfish biologists, NMFS food-science investigators, and FRED Division Pathology Section staff are cooperating in an additional study to determine: (1) if bitter crabs may be harvested earlier in the year and subsequently used commercially; (2) the cause for the bitter flavor of infected meats; and (3) potential alternative uses or products from infected crabs with tainted flavor. The disease still remains serious in southeast Alaska in that fishermen did not crab in upper Lynn Canal due to the very high prevalence of the disease, making such crabs unmarketable. The occurrence of the disease in the Bering Sea is of concern, but presently does not appear to be seriously impacting the fishery.

***Certification for Import of Oyster Spat into Alaska*:**

Two Northwest vendors, Westcott Bay in Washington and Kuiper Mariculture of California, continue to be recertified yearly for importation of Japanese oyster spat into Alaska. There presently is no shortage of spat for Alaskan growers.

***Pacific Northwest Fish Health Protection Committee (PNFHPC)*:**

In 1990 ADF&G became a member of the PNFHPC, which is comprised of state, federal, tribal, and private agencies within the Pacific Northwest and Intermountain states and Canadian provinces. The committee functions as an informational and problem-solving forum for fish-disease concerns within the various states and Canada, holding meetings every 6 months. Participants include technical representatives that are primarily fish pathologists and upper-level fisheries managers, including the FRED Division principal fish pathologist and chief of technology and development. This committee was very instrumental in determining courses of action regarding the recent VHSV isolations in Washington State, and now is concerned with negotiations between the USF&WS and Food and Drug Administration (FDA) regarding the current restrictions on chemicals and drugs used in aquaculture.

***IHNV Susceptibility Studies in Subarctic Species*:**

A series of experiments were initiated to determine the susceptibility of lake trout, Arctic char, and Arctic grayling to the IHN virus because of numerous transports of sockeye salmon and potentially IHNV to various watersheds containing these resident species. The information generated is new in that no information exists in the scientific literature regarding the ability of IHNV to infect these fish species. The results indicated that Arctic char and grayling were refractory to IHNV, but that lake trout sustained infection with minor

mortality. Lake trout could become possible carriers of the virus, if exposed. These results will eventually be submitted for publication in a professional journal.

VHSV Monitoring:

In August 1990 VHS virus was isolated by FRED Division Anchorage Fish Pathology Laboratory staff from skin-lesion material from a sport-caught Pacific cod in Prince William Sound. Examination by transmission electron microscopy (TEM) in the Juneau Fish Pathology Laboratory confirmed that the isolate was indeed a bullet-shaped rhabdovirus similar in appearance to IHNV. The isolate was then sent to the USF&WS Laboratory at Sand Point in Seattle for further testing. There, the cod virus was identified by serum neutralization as VHSV F1 strain, a serious pathogen in the European rainbow trout industry and recently isolated from returning coho and chinook salmon in the State of Washington. The isolation of this virus from Washington fish in 1989 and 1990 has been cause for great concern, and many fish have been destroyed in order to eradicate the virus. The virus was not reisolated from any Washington stocks in 1991.

In August 1991 a second sample of Pacific cod skin from Prince William Sound, having similar ulcerations, yielded another VHSV isolate. The same steps of TEM examination and serum neutralization were followed for confirmation of the virus as VHSV F1 strain.

The cod VHSV is a very significant discovery since the source of VHSV in the Washington fish was a mystery. However, a saltwater reservoir for the virus now appears very plausible because of the following results: The virus is more stable in salt water than in fresh water, and primarily salmonids returning from the ocean have been positive for the virus in Washington. Also, the Washington isolates have not shown significant pathogenicity for many salmonid species tested in the laboratory. Perhaps the most significant data resulted from the T-ribonuclease-fingerprinting tests conducted by a University of Washington graduate student in which the cod isolate was found to be genetically similar to the Washington VHSV isolates which are distinctly different from the European strain of VHSV. Although further work must be completed to determine the true nature of the Pacific cod VHSV, it is possible that the virus has been in Pacific cod all along and, possibly, other saltwater fishes. The salmonids may interact directly or with a prey species common to the cod that may allow for infection of the salmonids prior to their return to Washington hatcheries. In 1979 a similar VHSV was isolated in Denmark from Atlantic cod having skin lesions, a condition later named the Ulcus Syndrome.

Although many salmonid stocks in Alaska have been examined for VHSV, no stock has been found to be positive. Further efforts in Alaska are being directed toward reisolating the virus from Pacific cod from various geographic locations to determine the distribution of the virus. Susceptibility studies using various salmonids and the Pacific cod isolate are to be conducted this spring by FRED Division pathology staff to determine the virulence of this virus.

Fisheries Library

During the first half of 1991 the Fisheries Library operated with pro rata funding, based on percentage of usage, from the three ADF&G fisheries divisions (Commercial Fisheries, Sport Fish, and FRED). Additionally, the OSIAR Division supplemented personnel costs for the

library assistant position. However, beginning with the new fiscal year, the FRED Division assumed primary fiscal responsibility and plans to fund the library as one of its divisional programs in forthcoming years. This new budgetary arrangement should allow services to continue unhindered and, once again, stabilize library funding.

Overall library-usage statistics are on par with previous years with a total number of 2,848 requests received through November. Year-to-date usage percentages among the fisheries divisions are: Commercial Fisheries Division-39%; Sport Fish Division-19%; and FRED Division-25%. Usage by the OSIAR Division continues to rise, with a total of 5%. However, with joint funding of some OSIAR Division positions and overlap of projects, it is becoming increasingly more difficult to categorically attribute all requests to specific divisions. Additionally, there has been a slight rise in "outside requests." These are requests generated by other libraries, natural resource agencies, and individuals seeking specific information. While requests have covered a broad spectrum of fisheries science, there has been an increased demand for information on the biological implications of mixed hatchery and wild stocks, the culture of king crab, and both temperature-induced and genetic marking of fish. As these patterns emerge, library staff try to keep distinct subject files on the respective topics to facilitate future requests for the same information.

This year the Fisheries Library joined with other local natural resource libraries to apply for a "library cooperation grant" through the Alaska State Library. Submitting the application as a "consortium," staff were able to obtain funding that had been previously unattainable by the individual libraries. The grant money will be used to make the collections more accessible by adding "gray" literature to the Western Library Network (WLN). The project will be done in phases over the next three years, and completion will be contingent upon additional grant rewards. With this year's award, the Fisheries Library will be able to purchase 2 CD-ROM (compact disc/read-only memory) players and a subscription to LASER CAT (WLN computerized bibliographic database) for 1992. Having direct access to this database will be a tremendous help for cataloging, locating holdings, and verifying bibliographic citations. An immediate benefit will be a decreased turnaround time in filling interlibrary loan requests.

As a result of the first annual Fish and Wildlife Special Librarians Conference, there is now formulation of a nationwide network of natural resource libraries. Plans include setting up a computer network for general communications and transfer of research information/ publications. Fisheries Library staff have recently started putting together a proposal to obtain federal funds for the software/hardware required to accomplish part of their goal. During the conference, staff also negotiated agreements with the Fish and Wildlife Reference Service and USF&WS' Office of Information Transfer to give staff access to their computerized bibliographies. In addition, all of the local natural resource libraries now have access to the Western Regional Aquaculture Consortium's (WRAC) on-line database maintained at the University of Idaho's Aquaculture Institute. In the near future, FRED Division technical publications will be added to the WRAC database.

Due to increasing demands for and escalating cost of bibliographic information, it is imperative that local, state, and nationwide cooperation exists between libraries. The Fisheries Library will continue participating in such arrangements, as the long-term benefits are well worth it.

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CHAPTER 12

THE MARICULTURE PROGRAM

Background

The Aquatic Farm Act (Section 19, Chapter 145, SLA 1988) was signed into law on 8 June 1988, authorizing the commissioner of ADF&G to issue permits for the construction or operation of aquatic farms, and hatcheries to supply aquatic plants or shellfish to aquatic farms. The intent of the program was to create an industry in the state that would contribute to the state's economy and strengthen the competitiveness of Alaska seafood in the world marketplace, broadening the diversity of products and providing year-round supplies of premium-quality seafood. The law limited aquatic farming to shellfish and aquatic plants. In 1990 CSHB 432 became law, prohibiting farming of finfish in the state.

Regulations to administer the aquatic farm program were developed by the resource agencies during 1988 and 1989. ADNR divided coastal Alaska into 11 districts. The law required that each district be opened annually for 60 days for farm-site application. Permits for farm or hatchery sites not located on state land may be applied for at any time.

The FRED Division Mariculture Program, in cooperation with the department's fisheries management and Habitat Divisions, carries out the statutory and regulatory responsibilities of the department pertaining to aquatic farming in Alaska.

The Mariculture Program responsibilities include:

- In cooperation with the Habitat Division, coordinate the permitting process for aquatic farms and hatcheries.
- Review aquatic farm and hatchery permit applications for site suitability and technical and operational feasibility.
- Issue and administer the department's aquatic farm and hatchery permits.
- Act as lead for interdivisional coordination of the aquatic farm program.
- Administer and coordinate aquatic stock acquisition permits for the purpose of supplying brood stock and seed stock to aquatic farms and hatcheries.
- Administer and coordinate the shellfish and aquatic plant transport permit system.
- Administer and coordinate research permits for aquatic farming and hatchery activities.
- Provide technical assistance to other divisions, agencies, and the public sector.
- Coordinate aquatic farming and hatchery research activities statewide.

Program Implementation

The FRED Division Mariculture Program continued to evolve in 1991. Budget constraints eliminated the research program and reduced technical assistance provided to the industry. The administrative workload associated with the large number of permittees continued to grow.

Considerable interaction with the other resource agencies, including ADEC, ADNR, the Governor's Division of Governmental Coordination (DGC), and federal agencies was required to review and revise the permitting process and insure coordination of effort. The Interagency Mariculture Workgroup (IAMWG) ceased to formally exist with the change of administration. An informal group of agency representatives met several times to review and revise the aquatic farm permit application form and to discuss applications. The FRED and Habitat Divisions continued to coordinate the farm-permitting process. The FRED Division coordinated the overall department program, reviewed permit applications, and issued aquatic farm permits. The Habitat Division coordinated the department's Alaska Coastal Management Program (ACMP) and statutory review, providing that information to DGC.

Permitting and administration responsibilities for aquatic stock acquisition, shellfish and aquatic plant transport, and Fish Resource (scientific/educational) permits were administered. One clerical position was assigned to the program to assist with administrative functions.

Forty-eight aquatic farm permit applications were received and processed in 1991. Thirty-one farm-operation permits were issued. Three permits were closed at the request of the respective permittees. Scientific/educational (research) and acquisition/transport permit applications were at levels consistent with the number of permitted farms (Table 12.1) and are expected to increase again in 1992, reflecting the increase in active farms.

A statewide opening of all aquatic farm districts is again scheduled for March/April 1992.

The FRED Division proposed a Mariculture Technical Center (MTC) for inclusion in the Governor's capital projects budget for FY 93. The commissioner supports the request and prioritized it in the top one-third of the projects submitted by ADF&G to the Governor for consideration. If funded, the MTC would be a central facility providing assistance to the industry through practical research and development, providing indigenous seed stocks not available from commercial sources, and providing space for private mariculture-development projects. The Alaska Shellfish Grower's Association (ASGA) voted unanimous support for the project and elected subcommittees to work with the department during project development. A committee composed of the FRED Division mariculture coordinator and University of Alaska staff met to initiate the site-selection process. Considering only technical criteria, locations were ranked according to physical and biological variables that would not compromise facility operations for any species of potential value to the industry. Two locations, Seward and Juneau, were determined to meet the criteria defined. Other sites (Sitka, Seldovia area) were determined to have features that would compromise the facility. Two sites, Kodiak and Yakutat, could not be evaluated because of insufficient information. A conceptual design and detailed cost estimate were prepared. Further work on the project was deferred, awaiting a determination on facility funding.

Table 12.1. 1991 Aquatic Farm Program permit data.

	Southeast Districts	Southcentral Districts	TOTAL
OPERATIONS			
Permit applications	10[1/]	38	48
Permits issued	2	29	31
Permits withdrawn	2	1	3
Permits pending or still in process	6	19	25
Permitted farms as of 12/31/91	26	30	56
Farms operating in 1991 that reported inventory	20	17	37
Farms in certified growing areas [2/]	17	22	39
RESEARCH			
No. permit applications received	5	4	9
Permits issued	4	2	6
Permits pending	0	1	1
SHELLFISH AND AQUATIC PLANT ACQUISITION/TRANSPORT			
Permit applications received	39	68	107
Permits issued	33	64	97
Permits pending	6	1	7

[1/] Includes 3 applications for significant permit amendments.

[2/] More than one farm may be located in a growing area as defined by DEC.

Aquatic Farm Operations

1991 was a pivotal year for the aquatic farm industry in Alaska. With the implementation of the Aquatic Farm Act, farmers could acquire a farm-site permit from ADNR that was a property right revokable only for breach of permit conditions. The initial permit is for a 3-year period, during which the permittee must attain goals agreed upon in the farm's development plan. Once the goals are attained, the permittee may apply for a 10-year lease, which is assignable. This adds stability to the industry and should provide some renumeration for the effort and investment of developing a farm site. A number of farms reached their development-plan goals in 1991. The first applications for conversion of ADNR permits to leases are expected in 1992.

Aquatic farmers aggressively pursued operations in 1991, even though the Southcentral permits were issued late in the spring. Thirty-seven of the 56 permitted farms reported inventory in the water at the end of 1991 (Table 12.2). At market size, this inventory was valued at over $2.7 million. Aquatic farm sales for 1991 were again slightly less than $100,000. Production was dominated by oysters, with a small number of mussels produced in southcentral Alaska. This was expected because no new farms had received permits by the beginning of the growing season, and the existing farms had taken a conservative approach to seed purchases and acquisition in 1989 and 1990.

Southeast farmers received an average of $0.28/oyster, up slightly from the $0.27 received in 1990. The Southcentral value was, as last year, higher at $0.42/oyster. This was down from $0.48 in 1990. The average price received for mussels was $1.73/lb. The amount of product sold was small, though, and probably does not reflect the price farmers are likely to receive for mussels as production increases. One farmer harvested wild, adult mussels and cycled them through his farm for periods of several weeks to a few months. Though legally definable as farm product, this "semi-farmed" product represented a quality question for the industry. For purposes of blue mussel value projections, $1.50/lb seemed attainable (Table 12.2). All prices were based upon landed value at the farms and did not take into account production or transportation costs.

A growing facet of the aquatic farm industry was employment opportunities provided by farm operations. Excluding owner-operators and nonresident managers or consultants, 94 individuals were employed by the farm industry this year, working over 3,600 person-days (Table 12.2). No figures for jobs in the processing sector were available at time of press.

Industry Projections

Though 1991 production was low, the end-of-year inventory of farm product was encouraging. Over 5.5 million oyster spat were purchased by Alaskan farmers. Production was regional in nature, attributable to successes of farms within the regions. The picture will change in 1992, though, primarily due to active native corporation farms in Southcentral. Southeast Alaska will cease to be the state's largest producer of farmed shellfish. Oysters available from the farms should increase significantly statewide. Mussel production is not expected to increase. No other species of shellfish or aquatic plants will contribute to farm sales.

Table 12.2. 1991 aquatic farm operations data.

	Southeast Districts	Southcentral Districts	TOTAL
SALES			
Oysters (ind.)	160,376[1/]	61,380	221,756
Value	$44,440	$25,780	$70,220
Mussels (lbs)	0	17,076	17,076
Value	$0	$29,628	$29,628
	Total Aquatic Farm Sales		$99,848
END-OF-YEAR INVENTORY			
Oysters (ind.)	4,933,600[2/]	2,849,655[1/]	7,783,255
Value ($0.35/ind)	$1,726,760	$997,379	$2,724,139
Mussels (lbs)	3,600	45,800	49,400
Value ($1.50/lb)	$5,400	$64,566	$69,966
	Total Aquatic Farm Inventory Value		$2,794,105
EMPLOYMENT SUMMARY			
No. employees	31[3/]	63[3/]	94
Days worked	1,921	1,700	3,621
No. volunteers	16[4/]	0	16
Days worked	55	0	55

[1/] One active farm did not report production data in 1991. 1990 information was used to extrapolate estimate in this table.

[2/] One active farm did not report end-of-year inventory.

[3/] Does not include farm owner or nonresident manager.

[4/] Includes participants at school-owned site.

Large-scale aquatic farm industry development was again constrained in 1991 by the lack of government assistance (loan funds, grants, etc.) and the general lack of loans or other sources of investment capital from the private sector. Out-of-state businesses did not show interest in investing in the industry this year. This is almost certain to change. Nationwide, shellfish production is constrained by pollution and competition for limited coastal resources. The major eastern U.S. production areas, such as Chesapeake Bay, have ceased to be a major factor in shellfish production. For the first time, the State of Washington became the largest oyster producer in the United States. There, increasing effects of pollution, upland development, and user conflicts are occurring and will limit growth of the industry. Washington has approximately half the number of permitted aquatic farms that Alaska has, though they are larger. British Columbia's industry is growing, receiving considerable support from the public sector. Alaska, with its clean waters and large amount of protected coastline, has an immense potential of becoming a major aquatic-farming area. Investment capital, the logistics of producing and selling product, and lack of a vertically integrated industry are major constraints that will have to be addressed before this can occur.

A major component lacking in Alaska is a hatchery industry to provide a dependable supply of seed to aquatic farms. No shellfish or aquatic plant hatcheries exist in-state. All oyster seed must be imported from Washington. Collection of indigenous seed stock is susceptible to the vagaries of nature. To help address this problem, The North Pacific Rim, representing native people in southcentral Alaska, committed to construction of an oyster hatchery in Seward. This facility is intended primarily to produce seed for native-owned farms in the area. If funded, the MTC will also help provide a consistent supply of shellfish and, possibly, aquatic plant seed until other commercial hatcheries come on-line.

The benefits of aquatic farming as a source of income and economic stability is of interest to a number of rural Alaskan communities. In 1991 development and site-suitability research was conducted near Angoon in Southeast and Chenega Bay in Southcentral. Active farms were being operated by the Klawock Heenya Corporation and Yak-Tat Kwaan in Southeast, and the Tatitlek Native Corporation in Southcentral. Considerable interest in aquatic farming was shown by villages on Kodiak Island, Prince William Sound, and the Kenai Peninsula. Even the educational community was involved, with Petersburg High School operating a for-profit farm.

CHAPTER 13

THE PRIVATE NONPROFIT HATCHERY PROGRAM

Background

The 1974 Alaska State Legislature authorized the commissioner of ADF&G to issue permits to PNP corporations for the operation of salmon hatcheries for ocean ranching. The intent of the program was to allow private ownership of salmon hatcheries that would contribute to the state's salmon fisheries. The cost of constructing and operating these hatcheries was to be derived from the sale of a portion of the returning fish.

The PNP Program, administered by the FRED Division in cooperation with the department's fisheries management divisions, carries out the statutory and regulatory responsibilities pertaining to public and private aquaculture in Alaska.

The PNP Program is responsible for:

- Comprehensive salmon production planning.
- Administration of the permitting process for PNP salmon hatcheries and fish resource (scientific/educational) aquaculture programs.
- Development of annual operations management plans for all public and private salmon hatcheries.
- Administration and coordination of the statewide fish and shellfish transport permit systems.
- Coordination of technical assistance to PNP hatcheries.
- Coordination of the development of and ADF&G relations with qualified regional aquaculture associations.
- Administration and coordination of the U.S./Canada fisheries enhancement program.

Regional Associations

Regional associations are comprised of representatives of commercial fishermen and other user groups in the region, including sport fishermen, subsistence fishermen, and members of local communities. Eight regional associations have been formed:

1. Southern Southeast Regional Aquaculture Association (SSRAA)
2. Northern Southeast Regional Aquaculture Association (NSRAA)

3. Prince William Sound Aquaculture Corporation (PWSAC)

4. Cook Inlet Aquaculture Association (CIAA)

5. Lower Yukon/Kuskokwim Regional Aquaculture Association (LY/KRAA)*

6. Bristol Bay Regional Aquaculture Association (BBRAA)

7. Kodiak Regional Aquaculture Association (KRAA)

8. Chignik Regional Aquaculture Association (CRAA)

These associations cooperate with the department in developing and maintaining regional salmon-production plans and in the implementation of various salmon rehabilitation and enhancement activities.

Comprehensive Salmon Planning

The 1976 law authorized the commissioner to designate regions of the state for the purpose of enhancing salmon production. This same law also established the formation of regional planning teams (RPT) to develop regional salmon plans. Each RPT consists of 6 voting members, with 3 department personnel appointed by the commissioner and 3 appointed by the board of directors of the appropriate regional aquaculture association. The duties and responsibilities of the RPTs have been mandated in a formal charter from the commissioner. The responsibilities of the RPTs in developing regional comprehensive salmon plans, including provisions for public involvement in the planning process, are described in regulations. The commissioner may also request the involvement of representatives of other federal and state agencies. The teams develop 20-year comprehensive plans, 5-year action (strategic) plans, and perform annual plan update and maintenance.

The status of planning by region follows:

1. ***Southern Southeast***

   The southern Southeast regional plans have been approved, and the team is in the plan-maintenance and update process.

2. ***Northern Southeast***

   The northern Southeast regional plans have been approved, and the team is in the plan-maintenance and update process.

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* Indicates inactive regional association

3. ***Yakutat***

No formal salmon-planning activities have occurred in Yakutat since approval of the 20-year regional plan. The plan has been accepted by the USFS as a basis for the development of land-management plans applicable to the region.

4. ***Prince William Sound***

The Prince William Sound Phase I and Phase II plans have been approved. The team has proceeded into development of a Phase III plan that will incorporate fisheries management, allocation of enhanced fish among user groups, and production of enhanced fish into one overall plan for Prince William Sound. The team anticipates completion of this plan in 1992.

5. ***Cook Inlet***

The planning-team efforts in Cook Inlet are presently directed toward watershed-system planning, with a goal of assessing the capacity of specific systems to sustain and maintain significant, naturally occurring salmon stocks. Watershed-system planning also includes an identification of opportunities for salmon-enhancement techniques designed to strengthen existing runs and create new runs. Provisions for user-group access and harvest preferences are given primary consideration in this planning process.

6. ***Kodiak***

The Kodiak regional plans were approved prior to 1988. During 1991 the RPT revised the Phase II plan to more accurately reflect production goals, project opportunities, and user-group needs. The revised plan is currently out for review and will be finalized by March 1992.

7. ***Bristol Bay***

The Bristol Bay RPT completed the comprehensive salmon plan for Bristol Bay in 1989. The plan is unique in that, unlike plans for other salmon-production regions in Alaska, it does not concentrate on fisheries enhancement through such strategies as hatcheries; rather, it emphasizes maintenance and restoration of fish habitat and effective management practices. The regional association in Bristol Bay became less active when its enhancement tax vote failed to pass. No further planning efforts are currently planned.

8. ***Lower Yukon/Kuskokwim***

In response to a consensus of Yukon River fishery interests, the FRED Division has developed a Yukon Fisheries Enhancement Initiative. With funding from the Legislature in FY 93 for the initiative, regional enhancement planning will be reactivated and expanded to include both the upper and lower Yukon River.

9. ***Alaska Peninsula Planning***

In 1990 an RPT was appointed to begin development of a comprehensive salmon plan for the Alaska Peninsula/Aleutian Islands/Area M Region. A public-review draft of the Area M plan is expected to be completed by April 1992.

10. ***Chignik***

The commissioner appointed an RPT in 1990 to initiate development of a comprehensive salmon plan for the Chignik Region. A draft plan is scheduled to be available for public review in April 1992.

11. ***Sikusuilaq Springs Hatchery Management Plan***

Residents of Kotzebue Sound have expressed interest in salmon-enhancement planning, and the FRED Division has established a core planning group to include ADF&G, the National Park Service, and the local borough to develop alternative production scenarios as part of basic management plan development for the Sikusuilaq Springs Hatchery. This planning should be completed in early 1992. These efforts could lead to formation of a regional aquaculture association and development of a regional plan for Kotzebue Sound.

PNP Hatchery Funding

Since 1977 funding necessary for the implementation of salmon rehabilitation and enhancement activities by PNP corporations has been obtained primarily through the Fisheries Enhancement Revolving Loan Fund administered by DCED. The loan program has gone through several modifications by the Legislature, the most recent occurring in 1987. The maximal loan amount available for an individual project is $10 million, with a payback period of up to 30 years at approximately a 9.5% interest rate. Payments and accrual of interest on these loans can be deferred for 6 to 10 years. Loans for projects not endorsed by the regional aquaculture association may also have these terms, except these loans are limited to a maximum of $1 million. Loans are available for the purpose of planning, construction, and operation of salmon rehabilitation and enhancement projects, primarily salmon hatcheries. These loans are secured through collateral that may include returning hatchery fish and enhancement-tax assessments of commercial fishermen.

Cumulative state loans secured by corporations for capital construction and operations, cumulative enhancement-tax revenues returned to the regional aquaculture associations, and revenue generated during 1991 by corporate sales of returning hatchery fish are presented in Table 13.1. Through 31 December 1991, $77.2 million has been borrowed by PNP corporations. Another $49.2 million has been generated through assessments. In 1991 PNP operators sold $6.4 million worth of fish to help pay for the operation of their hatcheries. This figure was less than half of the $13.6 million generated from sales of fish in 1990, even though 19% more fish were sold in 1991 than in 1990.

Table 13.1. Cumulative state loans and enhancement funds returned to associations (through December 31, 1991), and annual fish sales for 20 private nonprofit (PNP) hatcheries (through Dec. 15, 1991).

Region/Corporation (number of permits)	State Loans		Cumulative Enhancement Funds Generated through Assessments, Returned to Associations via Contract	Estimated Revenue From 1991 Sales of Fish Returning to Special Harvest Areas
	For Capital Construction	For Operations		
SOUTHERN SOUTHEAST				
Southern Southeast Regional Aquaculture Association-SSRAA (3)	$9,093,000.00	$2,848,942.00	$15,767,064.21 (note 1)	$1,055,898.81
Alaska Aquaculture,Inc.-AAI (1)	$1,102,020.00	$2,962,784.00	N/A	$60,732.56
Meyers Chuck Aquaculture Association-MCAA (1)	$10,000.00	$0.00	N/A	N/A
NORTHERN SOUTHEAST				
Northern Southeast Regional Aquaculture Association-NSRAA (3)	$2,724,265.00	$1,638,496.00	$9,263,818.89 (note 1)	$1,570,861.37
Armstrong-Keta, Inc.- AKI (1)	$2,618,645.00	$2,229,500.00	N/A	$209,203.24
Burro Creek Farms, Inc.-BCF (1)	$51,500.00	$332,875.00	N/A	$15,645.75
Douglas Island Pink and Chum Inc.-DIPAC (3)	$9,171,000.00	$5,956,000.00	N/A	$412,901.00
Kake Nonprofit Fisheries Corp.-KNFC (1)	$1,500,724.00	$1,845,060.00	N/A	$105,649.56
Sheldon Jackson College-SJC (1)	$362,254.00	$61,370.00	N/A	$0.00
Tlingit and Haida Fisheries Development Corp.-THFDC (0)	$1,464,000.00	$89,860.00	N/A	N/A
PRINCE WILLIAM SOUND				
Prince William Sound Aquaculture Corp.-PWSAC (3)	$21,475,419.00	$1,085,500.00	$9,475,480.53 (note 2)	$1,128,290.00
Valdez Fisheries Development Assoc.-VFDA (1)	$3,193,830.00	$3,250,543.00	N/A	$1,758,059.00
COOK INLET				
Cook Inlet Regional Aquaculture Assoc.-CIAA (2)	$1,438,881.00	$683,369.00	$10,273,010.64 (note 2)	$78,946.00
KODIAK				
Kodiak Regional Aquaculture Assoc.-KRAA (1)	$0.00	$0.00	$4,383,450.56 (note 2)	$0.00
STATEWIDE TOTALS	$54,205,538.00	$22,984,299.00	$49,162,824.83	$6,396,187.29

note 1: 3% mandatory assessment tax collected collected from commercial fishermen.

note 2: 2% mandatory assessment tax collected from commercial fishermen.

Program Implementation

The application procedures and standards for issuance of PNP salmon hatchery permits are defined by regulations adopted in 1985. These regulations require the completion of a management feasibility analysis by ADF&G prior to the submission of a PNP hatchery application. This analysis must be completed within 30 days after the applicant provides the information requested in 5 AAC 40.130 of the regulations. The application process takes as few as 135 days and is designed to comply with the coastal zone consistency-review process established by the Governor's Office of Management and Budget.

The appropriate RPT reviews each application and makes a recommendation to the commissioner on the application's compatibility with the regional comprehensive plan. The RPT uses review criteria that are defined in the PNP regulations.

PNP permit holders may request alterations of their permits and basic management plans, based on accumulated experience and changing conditions. The RPT may review and make a recommendation to the commissioner on a permit-alteration request. The team's review is conducted in accordance with performance standards identified in the PNP regulations.

Since the inception of the PNP Program, 30 salmon-hatchery permits have been issued and 3 given up. The department is currently in the process of revoking another PNP permit. Thirty-nine applications have been either denied or withdrawn from the process. Four permits were issued to regional aquaculture associations for the operation of state-owned hatcheries at Trail Lakes, Cannery Creek, Kitoi Bay, and Hidden Falls Hatcheries. Additional permits will be issued for operation of the Tutka Bay, Main Bay, and Beaver Falls state-owned facilities in 1992.

Twenty-two of the permitted PNP hatcheries are in operation, and all but one (Bell Island) had returns of adult salmon during 1991. Currently, there are 3 applications for PNP hatchery permits under consideration. Another application is expected early in 1992 for a chum salmon hatchery on Kodiak Island.

Locations of operational PNP programs and remote-release sites are illustrated in Figures 13.1, 13.2, and 13.3.

Hatchery Production

In 1991 PNP corporations estimated that 40.3 million adult salmon originally released as juveniles from corporate facilities were either harvested in common-property fisheries or returned to hatchery special harvest areas (Table 13.2). Not included in this figure are 1.7 million hatchery returns to the Kitoi Bay Hatchery, 459,000 sockeye salmon returns to Main Bay Hatchery, and 306,000 pink salmon returns to the Tutka Bay Hatchery that were already considered under FRED Division hatchery production elsewhere in this report. Total returns increased for all species except pink salmon in 1991. In Prince William Sound, returns to PNP hatcheries were estimated by the operators to have contributed over 20.9 million pink salmon to the commercial fishery. That contribution represents 84% of the total harvest of

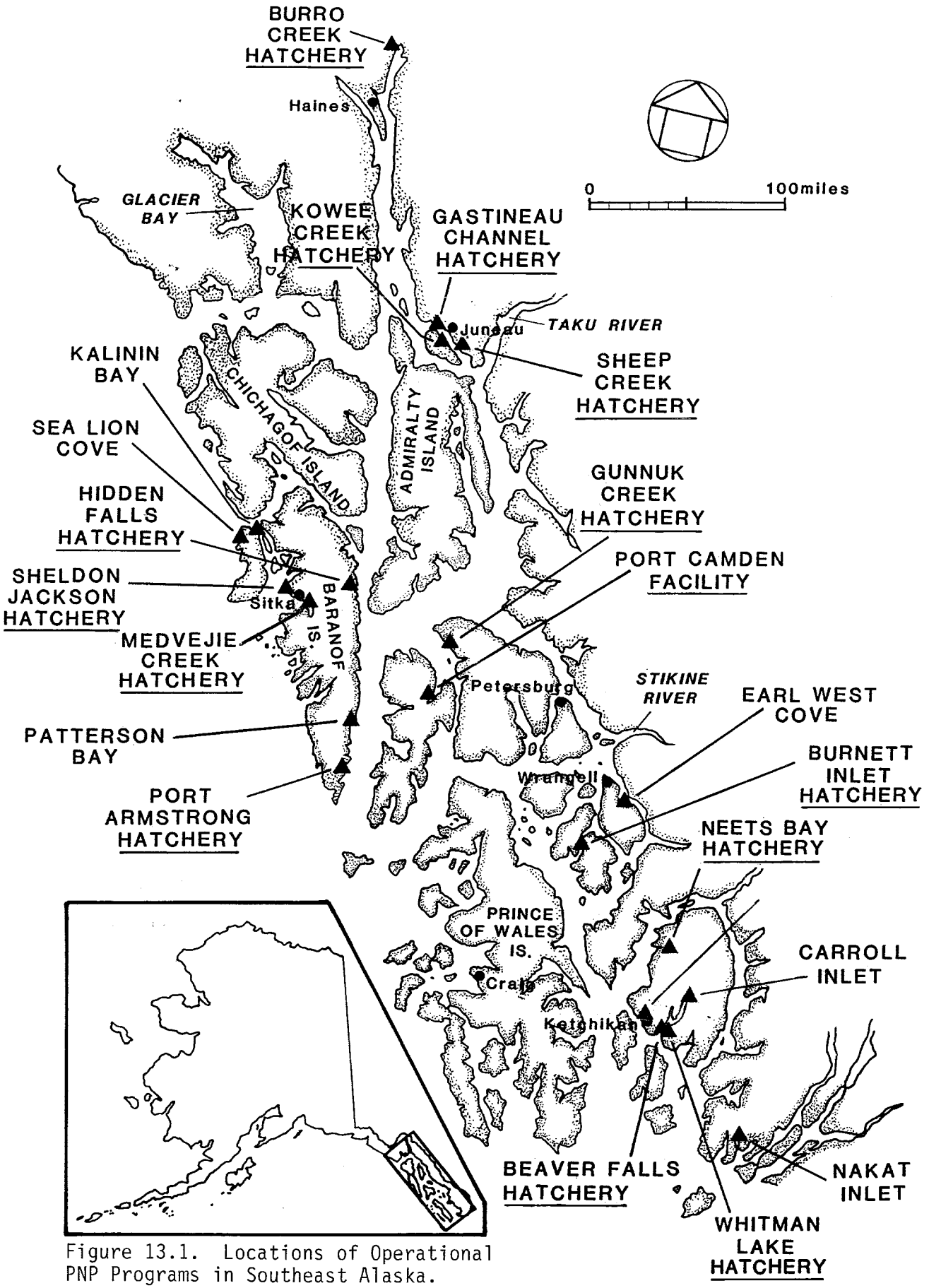

Figure 13.1. Locations of Operational PNP Programs in Southeast Alaska.

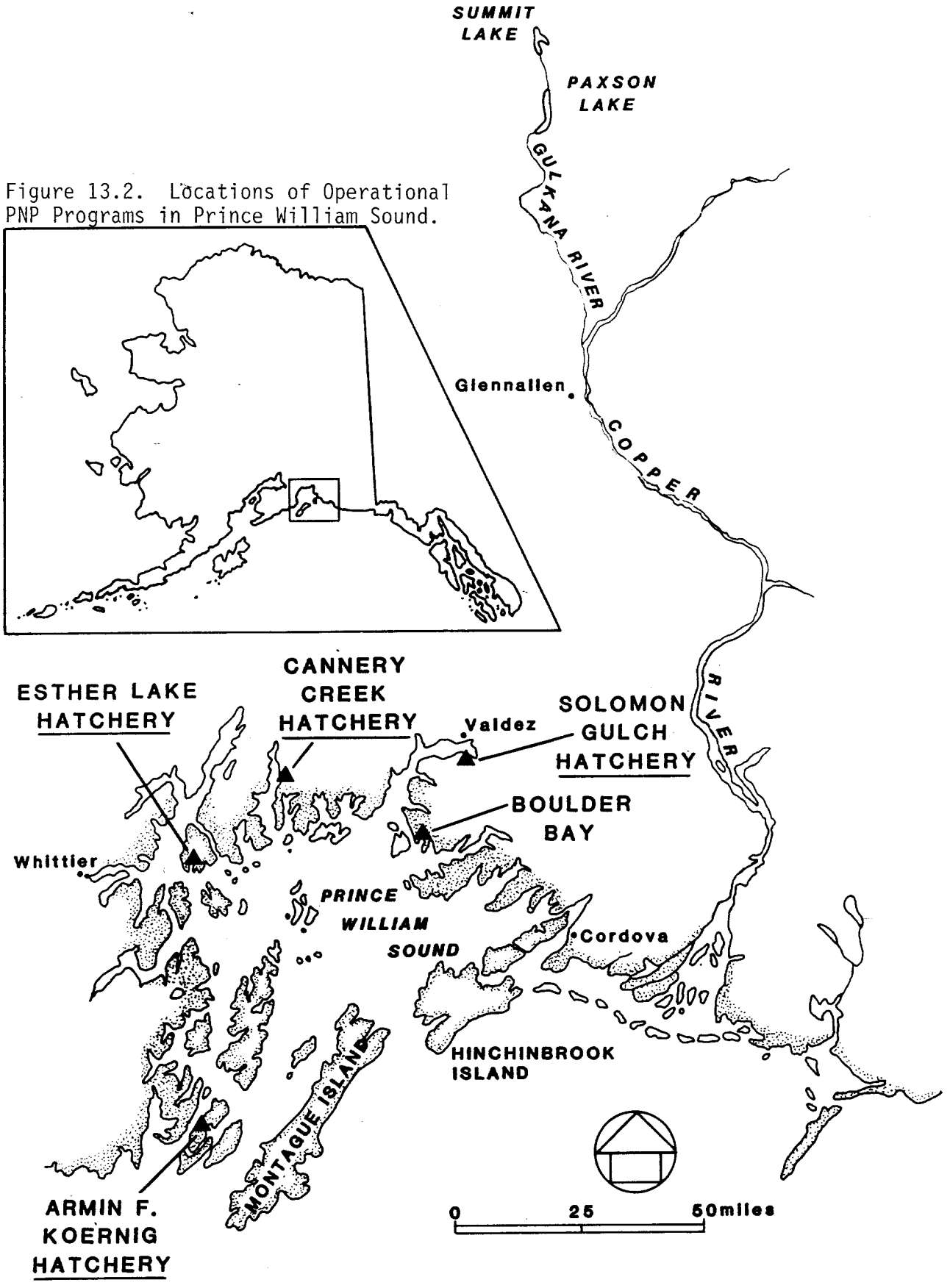

Figure 13.2. Locations of Operational PNP Programs in Prince William Sound.

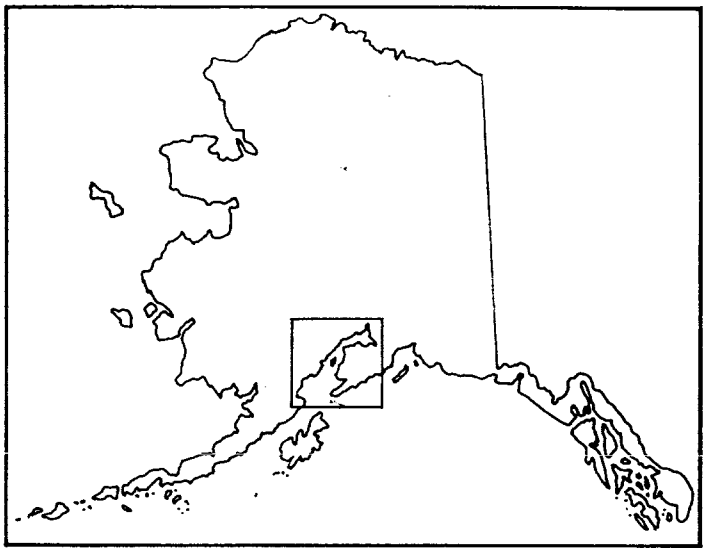

Figure 13.3. Locations of Operational PNP Programs in Cook Inlet.

Table 13.2. 1991 estimated adult returns, by species, to PNP hatcheries (including common property harvests) as reported by operators.

REGION / LOCATION		Pink	Chum	Coho	Chinook	Sockeye	TOTAL	
	SOUTHEAST							
SSRAA	- Whitman Lake			35,303	3,295		38,598	(note 1)
	Carroll Inlet				28,454		28,454	(note 1)
	Earl West Cove		31,345	25,675	16,625		73,645	(note 1)
	Naket Inlet		94,120	13,675			107,795	(note 1)
	- Neets Bay		316,375	288,982	9,495		614,852	(note 1)
	- Beaver Falls					3,873	3,873	(note 1)
	Shrimp Bay					136	136	(note 1)
NSRAA	- Hidden Falls		869,901	10,152	2,065		882,118	(note 1&4)
	- Medvejie Creek		53,962	11,721	6,450		72,133	(note 1&4)
	Patterson Bay			168,238			168,238	(note 1)
AAI	- Burnett Inlet	450,583	47,006	4,589	150		502,328	(note 1&2)
AKI	- Port Armstrong	1,385,152	1,955	27,090	835		1,415,032	(note 1&2)
BCF	- Burro Creek	1,012	1,112	1,370			3,494	(note 1&2)
DIPAC	- Sheep Creek	259,697	201,469				461,166	(note 1)
	- Kowee Creek	2,033	422				2,455	(note 1)
	- Gastineau	82,641	2,437	252,679	105		337,862	(note 1)
KNFC	- Gunnuk Creek	75,696	37,794				113,490	(note 2)
	Southeast Cove	79,393	18,163				97,556	(note 2)
SJC	- Indian River	22,744	23	1,812	505		25,084	(note 1&3)
	SOUTHEAST TOTALS	2,358,951	1,676,084	841,286	67,979	4,009	4,948,309	
	PRINCE WILLIAM SOUND							
PWSAC	- Armin F. Koernig	5,907,432					5,907,432	(note 1&4)
	- Esther Lake	13,700,566	241,713	92,756	1,947		14,036,982	(note 1&4)
	- Cannery Creek	8,992,572					8,992,572	(note 1&4)
	- Main Bay	Listed under FRED hatchery production						
VFDA	- Solomon Gulch	4,447,423	13,721	54,794			4,515,938	(note 1&4)
	Boulder Bay	1,674,397					1,674,397	(note 1&4)
	PWS TOTALS	34,722,390	255,434	147,550	1,947	0	35,127,321	
	COOK INLET							
CIAA	- Eklutna		27,020	1,786			28,806	(note 2)
	- Trail Lakes			10,716		149,597	160,313	(note 2)
	- Tutka	Listed under FRED hatchery production						
	Halibut Cove							
	COOK INLET TOTALS	0	27,020	12,502	0	149,597	189,119	
	KODIAK							
KRAA	- Kitoi Bay	Listed under FRED hatchery production					0	
	KODIAK TOTALS	0	0	0	0	0	0	
STATEWIDE TOTALS		37,081,341	1,958,538	1,001,338	69,926	153,606	40,264,749	

note 1: estimation based on expansion of coded wire tag recoveries.
note 2: estimation based on assumed common property interception rates.
note 3: estimation based on assumed marine survival rates.
note 4: estimation based on information provided by Division of Commercial Fisheries.

pink salmon in Prince William Sound. SSRAA estimates its hatcheries at Neets Bay and Whitman Lake contributed over 477,000 chum, coho, and chinook salmon to the common-property fisheries in Southeast. Over 1 million coho salmon were produced by PNP hatcheries in 1991, and common-property fisheries harvested over 608,000 of the returning adults. Estimated hatchery returns for 1991, including commercial, sport, and cost-recovery harvests, are presented by region and species in Table 14.1 of the next chapter.

Statewide production data since 1975 for combined species, including adult returns and harvests, are presented in Table 13.3. Preliminary estimates by the PNP corporations indicate that common-property harvests of the 1991 return were over 23 million fish. Cumulative data for chum salmon produced by PNP corporations since 1975 are presented in Table 13.4. Similar data for sockeye, pink, coho, and chinook salmon are presented in Tables 13.5, 13.6, 13.7, and 13.8, respectively.

Egg takes and fry or smolt stocking are regulated by ADF&G through FTPs, which are administered by the PNP Program. In 1991, 226 FTPs were processed by the program. During 1991 fry and smolt releases increased to almost 1.1 billion juvenile fish, an increase of almost 162 million (or 17%) from 1990 levels (Table 13.9). 1991 marks the first time releases from PNP hatcheries exceeded 1 billion fish. 1991 egg takes for PNP hatcheries totaled over 1.325 billion green eggs, up 77 million (or 6%) from 1990 levels. The largest egg take of 1991 was at Esther Lake Hatchery, where over 297 million pink, chum, coho, and chinook salmon eggs were taken for incubation (Table 13.10). This was followed by the Valdez Fisheries Development Association's Solomon Gulch Hatchery with over 208 million pink, chum, and coho salmon eggs, PWSAC's Cannery Creek Hatchery with over 153 million pink salmon eggs, and PWSAC's Armin F. Koernig Hatchery with over 127 million pink salmon eggs. In total, more than 795 million salmon eggs were taken by PNP operators in Prince William Sound in 1991. In southeast Alaska, Douglas Island Pink and Chum, Inc. took over 142 million pink, chum, chinook, and coho salmon eggs for its facilities, NSRAA took over 119 million pink, chum, coho, and chinook salmon eggs for its three hatcheries, and SSRAA took over 98 million chum, coho, chinook, and sockeye salmon eggs for its three hatcheries.

Significant progress was made in 1991 in initiating sockeye salmon production from PNP hatcheries. Releases of juvenile sockeye salmon totaled over 8.0 million in 1991. Sockeye salmon egg takes totaled 27.5 million eggs at permitted PNP hatcheries and those operated by PNP aquaculture associations under contract to the state. Significant increases in chinook, chum, pink, and coho salmon production also were made in 1991. The most noticeable increases were in chinook and coho salmon production with respective 13.8% and 10.2% increases over 1990 in numbers of eggs taken. In 1991 pink salmon production increased by 5.3% and chum salmon production by 3.8% over 1990 egg-take levels.

Many PNP hatcheries are still in the process of brood stock development and, consequently, have not reached their permitted capacities. Permitted capacities for PNP hatcheries now total over 1.76 billion eggs, an increase of 48.3 million from 1990 levels (Table 13.11). Potential returns from statewide PNP hatchery-originated production at the 1.8 billion-egg level should exceed 30 million adults annually, assuming FRED standard assumptions of hatchery and marine survival. Exceptional marine survival, similar to that experienced during recent years, could boost adult production considerably over these estimates. Under

Table 13.3. Summary of statewide salmon production (all species) from PNP hatcheries as reported by operators.

Year	Egg Take	Fry or smolt release	Total return	Special harvest	Hatchery revenue
1975	8,091,395				
1976	16,622,881	3,719,741			
1977	37,008,186	12,360,354	160,147	108,718	$130,726.00
1978	37,346,167	26,796,238	160,967	114,188	$141,799.00
1979	54,295,879	29,131,774	356,501	244,555	$309,612.00
1980	125,740,500	35,587,200	1,506,466	346,168	$436,171.00
1981	223,600,000	101,600,000	2,563,913	850,293	$1,274,640.00
1982	234,390,000	126,990,000	5,340,720	1,370,110	$1,165,608.00
1983	261,310,000	170,375,000	4,285,989	744,767	$669,838.00
1984	372,880,000	217,730,000	4,764,144	1,048,701	$1,668,788.00
1985	469,960,000	302,320,000	8,106,485	1,853,483	$1,878,348.00
1986	522,200,000	380,890,000	7,903,526	1,211,620	$1,867,054.45
1987	868,250,000	461,170,000	19,096,871	4,172,700	$6,557,877.16
1988	1,045,620,000	819,800,000	14,343,654	2,499,557	$9,266,780.00
1989	1,108,700,000	860,190,000	24,044,699	14,849,608	$28,985,391.36
1990	1,249,160,000	925,210,000	42,405,072	10,387,754	$13,644,040.77
1991	1,325,990,000	1,087,070,000	40,264,749	12,377,204	$6,396,187.29
	Cumulative hatchery revenue from special harvest:				$74,392,861.03

Table 13.4. Summary of chum salmon production from PNP hatcheries.

Year	Egg Take	Fry release	Total return	Special harvest	Hatchery revenue
1975	77,000				
1976	347,275	66,075			
1977	1,614,574	264,068			
1978	1,684,930	1,064,000	543		
1979	6,782,864	924,400	3		
1980	26,850,000	3,340,000	1,588		
1981	32,400,000	21,900,000	20,518	6,115	$24,640.00
1982	46,130,000	23,590,000	22,133	378	$302.00
1983	68,790,000	41,770,000	126,783	35,099	$37,120.00
1984	122,170,000	54,780,000	1,001,449	436,617	$690,393.00
1985	119,450,000	97,880,000	525,088	123,215	$209,208.00
1986	181,450,000	100,490,000	779,637	188,754	$303,080.00
1987	234,500,000	149,790,000	955,294	487,605	$1,162,578.50
1988	369,610,000	186,050,000	1,835,164	469,754	$2,180,685.40
1989	267,030,000	286,770,000	1,102,191	183,340	$754,806.00
1990	425,410,000	216,860,000	1,632,539	369,985	$1,411,640.43
1991	441,530,000	359,270,000	1,958,538	403,603	$1,269,086.65

Table 13.5. Summary of sockeye salmon production from PNP hatcheries

Year	Egg Take	Fry or smolt release	Total return	Special harvest	Hatchery revenue
1985	310,000	0	0	0	$0.00
1986	1,295,700	102,000	0	0	$0.00
1987	1,570,000	750,000	0	0	$0.00
1988	10,590,000	1,000,000	66,499	0	$0.00
1989	14,740,000	8,030,000	39,832	39,831	$254,214.80
1990	11,780,000	8,140,000	101,216	8,513	$35,506.20
1991	27,480,000	8,070,000	153,606	5,023	$21,167.36

Table 13.6. Summary of pink salmon production from PNP hatcheries.

Year	Egg Take	Fry release	Total return	Special harvest	Hatchery revenue
1975	8,002,395				
1976	16,251,456	3,653,666			
1977	35,383,112	12,093,184	160,147	108,718	$130,726.00
1978	34,851,807	25,732,238	160,397	114,188	$141,799.00
1979	46,582,015	28,204,674	356,498	244,555	$309,612.00
1980	98,030,000	31,690,000	1,504,878	346,168	$436,171.00
1981	188,000,000	78,800,000	2,491,345	838,037	$1,200,000.00
1982	185,170,000	102,550,000	5,253,378	1,354,732	$1,084,806.00
1983	185,520,000	126,890,000	4,086,552	701,399	$613,618.00
1984	241,760,000	159,340,000	3,637,927	583,185	$741,673.00
1985	339,910,000	199,490,000	7,404,789	1,698,732	$1,320,320.00
1986	324,570,000	271,960,000	6,767,984	948,624	$1,012,420.00
1987	618,350,000	299,260,000	17,963,785	3,624,586	$4,711,068.00
1988	645,100,000	625,820,000	12,257,959	2,007,720	$6,715,887.09
1989	805,870,000	553,090,000	22,561,056	14,519,987	$27,380,702.66
1990	788,710,000	684,790,000	39,919,911	9,846,364	$10,846,114.44
1991	830,860,000	704,330,000	37,081,341	11,574,828	$2,890,652.41

Table 13.7. Summary of coho salmon production from PNP hatcheries.

Year	Egg Take	Fry or smolt release	Total return	Special harvest	Hatchery revenue
1975	12,000				
1976	24,150				
1977	10,500	3,102			
1978	809,430	0	27		
1979	931,000	2,700	0		
1980	666,500	557,200	0		
1981	2,800,000	900,000	52,050	6,141	$50,000.00
1982	2,870,000	700,000	61,709	11,500	$80,500.00
1983	6,200,000	1,570,000	71,781	7,396	$19,100.00
1984	6,300,000	3,230,000	121,112	27,310	$233,466.00
1985	4,100,000	4,220,000	168,427	29,530	$293,820.00
1986	8,300,000	4,280,000	344,749	72,960	$535,203.00
1987	9,280,000	5,440,000	169,149	58,333	$625,546.65
1988	13,310,000	4,720,000	122,186	13,383	$178,771.15
1989	13,740,000	9,040,000	305,048	88,702	$271,181.23
1990	14,470,000	10,730,000	691,680	140,728	$939,670.50
1991	16,120,000	11,500,000	1,001,338	372,612	$1,873,708.61

Table 13.8. Summary of chinook salmon production from PNP hatcheries.

Year	Egg Take	Fry or smolt release	Total return	Special harvest	Hatchery revenue
1980	194,000				
1981	400,000				
1982	220,000	150,000	3,500	3,500	N/A
1983	800,000	140,000	872	872	N/A
1984	2,730,000	380,000	3,656	1,589	$3,256.00
1985	6,180,000	720,000	8,181	2,006	$55,000.00
1986	6,580,000	4,050,000	11,156	1,282	$16,351.00
1987	4,550,000	5,940,000	8,643	2,176	$58,684.00
1988	7,010,000	2,210,000	23,246	8,700	$191,436.36
1989	7,330,000	3,270,000	36,572	17,748	$324,486.67
1990	8,790,000	4,700,000	59,726	22,164	$411,109.20
1991	10,000,000	3,900,000	69,926	21,138	$333,572.26

N/A = information not available

Table 13.9. 1991 releases from PNP hatcheries in millions.

REGION/LOCATION		Pink	Chum	Coho	Chinook	Sockeye	TOTAL
SOUTHEAST							
SSRAA	- Whitman Lake			0.30	0.07	*	0.38
	Carroll Inlet				1.10		1.10
	Kendrick Bay		6.21				6.21
	Naket Inlet		11.77	0.10			11.87
	Earl West Cove		6.02	0.21	0.40		6.63
	- Neets Bay		44.61	2.22	0.39		47.21
	- Beaver Falls				0.03	1.42	1.45
	Shrimp Bay					0.31	0.31
NSRAA	- Hidden Falls		37.69	0.06	0.18		37.93
	Takatz		26.59				26.59
	- Medvejie Creek		4.80	1.93	0.87		7.60
	Deep Inlet		24.85	0.10			24.95
	- Port Camden		2.40				2.40
AAC	- Bell Island			0.01	0.01		0.01
AAI	- Burnett Inlet	8.97	2.98	0.06	0.10		12.11
AKI	- Port Armstrong	50.12	0.79	0.21	0.06		51.18
BCF	- Burro Creek	1.70	0.002	0.01	*		1.70
DIPAC	- Kowee Creek	*	*				0.00
	- Sheep Creek	*	26.95	*			26.95
	- Gastineau	14.85	11.33	0.51	0.04		26.72
	Sheep Creek	16.26	10.92	0.51			27.69
	Amalga Harbor		34.74				34.74
	Boat Harbor		9.26				9.26
	Limestone Inlet		9.03				9.03
KNFC	- Gunnuk Creek	2.02	5.92				7.94
	Southeast Cove	4.40	1.15				5.55
SJC	- Indian River	2.50	0.28	0.05	0.05		2.88
	SOUTHEAST TOTALS	100.81	278.28	6.27	3.31	1.73	390.40
PRINCE WILLIAM SOUND							
PWSAC	- Armin F. Koernig	115.75	*				115.75
	- Esther Lake	205.73	76.84	2.08	0.24	*	284.89
	Main Bay	9.24					9.24
	Whittier			0.10	0.10		0.20
	Cordova			0.04	0.06		0.10
	Valdez				0.19		0.19
	- Cannery Creek	141.51	*				141.51
	- Main Bay		Listed under FRED hatchery production				
VFDA	- Solomon Gulch	82.88	1.61	0.96			85.45
	Boulder Bay	48.42		0.03			48.45
	PWS TOTALS	603.52	78.45	3.22	0.59	0.00	685.78
COOK INLET							
CIAA	- Eklutna	*	2.54	0.02	*		2.56
	- Trail lakes			1.99	*	6.35	8.34
	- Tutka Bay		Listed under FRED hatchery production				
	COOK INLET TOTALS	0.00	2.54	2.01	0.00	6.35	10.89
KODIAK							
KRAA	- Kitoi Bay		Listed under FRED hatchery production				
	KODIAK TOTALS	0.00	0.00	0.00	0.00	0.00	0.00
	STATEWIDE TOTALS	704.33	359.27	11.50	3.90	8.07	1087.07

Note 1: * indicates permitted species but no releases this season.

Note 2: individual hatchery releases may not add up to the regional or statewide totals because of rounding.

Table 13.10. 1991 egg takes for PNP hatcheries in millions.

REGION / LOCATION		Pink	Chum	Coho	Chinook	Sockeye	TOTAL	Comments:
SOUTHEAST								
SSRAA	- Whitman Lake		25.68	5.39	4.32	*	35.40	(note 1)
	- Neets Bay		56.41		0.67		57.08	
	- Beaver Falls					5.70	5.70	
NSRAA	- Hidden Falls		82.10	0.49	2.50		85.09	
	- Medvejie Creek	0.25	25.97	2.89	0.88		30.00	
	- Port Camden		4.61				4.61	
AAI	- Burnett Inlet	20.29	20.91	*	*		41.20	
AKI	- Port Armstrong	41.85	0.44	0.56	0.03		42.89	
BCF	- Burro Creek	0.27	0.42	0.05	0.02		0.77	
DIPAC	- Kowee Creek	*	*				0.00	(note 1)
	- Sheep Creek	*	28.40	*			28.40	(note 1)
	- Gastineau	50.86	61.76	1.10	0.36		114.07	
KNFC	- Gunnuk Creek	5.98	14.26				20.24	
SJC	- Indian River	9.52	0.005	0.13	0.13		9.78	
	SOUTHEAST TOTALS	129.02	320.96	10.61	8.92	5.70	475.21	(note 2)
PRINCE WILLIAM SOUND								
PWSAC	- Armin F. Koernig	127.26	*				127.26	
	- Esther Lake	180.47	113.49	2.67	1.07	*	297.71	
	- Cannery Creek	153.75	*				153.75	(note 1)
	- Main Bay					8.80	8.80	
VFDA	- Solomon Gulch	202.96	3.06	2.04	*		208.06	(note 1)
	PWS TOTALS	664.44	116.56	4.70	1.07	8.80	795.58	(note 2)
COOK INLET								
CIAA	- Eklutna	*	3.96	0.15	*		4.11	(note 1)
	- Trail Lakes			0.66	*	12.97	13.63	(note 1)
	- Tutka Bay	37.40	0.05				37.45	
	COOK INLET TOTALS	37.40	4.02	0.81	0.00	12.97	55.20	(note 2)
KODIAK								
KRAA	- Kitoi Bay	Listed under FRED hatchery production						
	KODIAK TOTALS	0.00	0.00	0.00	0.00	0.00	0.00	(note 2)
	STATEWIDE TOTALS	830.86	441.53	16.12	10.00	27.48	1325.99	

ALL SPECIES TOTAL: 1,325,990,000

Note 1: * indicates permitted species but no egg take this season.
Note 2: individual hatchery egg takes may not add up to the regional or statewide totals because of rounding.

Table 13.11. Permitted egg capacities, in millions, of PNP hatcheries within the planning regions, 1991.

REGION	Pink	Chum	Coho	Chinook	Sockeye	Steelhead	Total
SOUTHERN SOUTHEAST							
Association Facilities	0.00	105.80	8.40	5.54	4.00		123.74
Non-Association Facilities	46.00	42.00	0.42	1.40		0.01	89.83
total	46.00	147.80	8.82	6.94	4.00		213.56
NORTHERN SOUTHEAST							
Association Facilities	0.30	136.00	3.55	5.50			145.35
Non-Association Facilities	138.00	251.50	3.25	0.85		0.09	393.69
total	138.30	387.50	6.80	6.35	0.00	0.09	539.04
YAKUTAT (no PNP facilities)							
total	0.00	0.00	0.00	0.00	0.00		0.00
PRINCE WILLIAM SOUND							
Association Facilities	508.00	129.00	4.00	4.00	31.00		676.00
Non-Association Facilities	240.00	28.00	2.00	0.30			270.30
total	748.00	157.00	6.00	4.30	31.00		946.30
COOK INLET							
Association Facilities	10.00	10.00	7.10	4.10	30.00		61.20
total	10.00	10.00	7.10	4.10	30.00		61.20
STATEWIDE TOTALS	942.30	702.30	28.72	21.69	65.00	0.09	1760.10

the existing permits, approximately 53% of hatchery capacity, is scheduled for pink salmon, 40% for chum salmon, and 7% for steelhead trout, sockeye, coho, and chinook salmon.

Projected returns to PNP facilities for the 1992 season are presented in Table 13.12. Approximately 79,500 chinook salmon, 500,000 coho salmon, 3,259,000 chum salmon, and 1,690,000 pink salmon are expected to return to PNP hatcheries in southeast Alaska. Returns to PNP facilities in Prince William Sound are projected at 29,983,000 pink salmon, 1,033,000 chum salmon, and 340,000 coho salmon for 1992. Projected returns are expected to be approximately the same in 1992 as actually occurred in 1991. Approximately 40 million fish returned in 1991; 41 million are expected in 1992.

Significant hatchery special harvests are expected at the Armin F. Koernig, Esther Lake, Cannery Creek, Solomon Gulch, Main Bay, Tutka Bay, Neets Bay, Whitman Lake, Port Armstrong, Burnett Inlet, Hidden Falls, Sheep Creek/Gastineau, Gunnuk Creek, and Medvejie Creek Hatcheries. Significant common-property terminal harvests by commercial gear groups are expected at the Kitoi Bay, Esther Lake, Cannery Creek, Hidden Falls, and Whitman Lake (Nakat Inlet, Carroll Inlet, and Earl West Cove) Hatcheries.

Annual Management Plans (AMP)

The PNP regulations require that ADF&G prepare, in conjunction with PNP permit holders, an AMP to guide hatchery operations for the succeeding calendar year.

AMPs will be developed for 17 state and 21 PNP hatchery facilities prior to the 1992 operating season. The AMPs will be reviewed by both the department and RPTs before final approval by the commissioner. The AMPs outline expected operational activities at each facility, including wild and hatchery egg takes, proposed fish and egg transports and releases, anticipated adult returns, anticipated impacts on the management of mixed-stock fisheries, and terminal harvest-management strategies. Also included are anticipated facility brood stock requirements and, in the case of PNP facilities, hatchery cost-recovery plans that identify legal gear types for hatchery harvest and the number of fish required in order to meet capital and operating expenses.

Fish Resource (Scientific/Educational) Permitting

Fish Resource (scientific/educational) permits for 71 aquaculture research projects or school district aquaculture programs were issued in 1991 by the commissioner. These permits are administered by the PNP Program. Forty-three of the permits issued in 1991 allowed the release of juvenile fish. These projects are listed in Table 13.13 by regions of the state. If all these projects operated at permitted capacities, 7.4 million pink, coho, chum, and sockeye salmon and steelhead trout would have been released under these permits.

In 1992 a new policy and regulations for scientific/educational collecting and propagation permits is being developed. The permits will now be called Fish Resource Permits, and will be issued for scientific collecting, holding, exhibition, and propagation of fish.

Table 13.12. Projected adult returns, by species, to PNP hatcheries for 1992 (including common property harvests) as reported by operators.

REGION/LOCATION		Pink	Chum	Coho	Chinook	Sockeye	TOTAL
	SOUTHEAST						
SSRAA	- Whitman Lake			22,200	2,950		25,150
	Earl West Cove		61,100	23,500	14,100		98,700
	Nakat Inlet		188,300	7,500			195,800
	Carroll Inlet				24,400		24,400
	- Neets Bay		850,200	234,700	18,200		1,103,100
	- Beaver Falls					18,000	18,000
	Shrimp Bay					1,500	1,500
NSRAA	- Hidden Falls		700,000	6,500	2,120		708,620
	Takatz Bay		235,000				235,000
	- Medvejie Creek		13,000		11,000		24,000
	Deep Inlet		62,500	10,000			72,500
	Mist Cove			74,000			74,000
	- Port Camden		9,152				9,152
AAI	- Burnett Inlet	360,000	5,349	3,000	2,130		370,479
AKI	- Port Armstrong	1,002,313	3,472	16,538	1,728		1,024,051
BCF	- Burro Creek	5,000	1,151	59			6,210
DIPAC	- Sheep Creek	81,200	680,600				761,800
	- Gastineau	74,200	269,600	50,682	283		394,765
	Boat Harbor		122,300				122,300
	Sheep Creek			50,682	1,803		52,485
KNFC	- Gunnuk Creek	50,495	20,842				71,337
	Southeast Cove	110,050	36,975				147,025
AAC	- Bell Island			270			270
SJC	- Indian River	7,500	165	1,300	841		9,806
	SOUTHEAST TOTALS	1,690,758	3,259,706	500,931	79,555	19,500	5,550,450
	PRINCE WILLIAM SOUND						
PWSAC	- Armin F. Koernig	5,636,954					5,636,954
	- Esther Lake	10,862,456	922,500	226,037	3,946		12,014,939
	Main Bay	449,747					449,747
	Cordova			4,340	287		4,627
	Whittier			10,849	279		11,128
	- Cannery Creek	6,424,712	65,819				6,490,531
	- Main Bay					745,546	745,546
VFDA	- Solomon Gulch	4,143,953	45,189	96,287			4,285,429
	Boulder Bay	2,420,801		3,076			2,423,877
	PWS TOTALS	29,938,623	1,033,508	340,589	4,512	745,546	32,062,778
	COOK INLET						
CIAA	- Eklutna		137,430	5,000			142,430
	- Trail Lakes						0
	Packers Lake					160,618	160,618
	Hidden Lake					46,265	46,265
	Bear Lake			6,790		23,990	30,780
	- Tutka Bay	504,000					504,000
	Halibut Cove	120,000					120,000
	COOK INLET TOTALS	624,000	137,430	11,790		230,873	1,004,093
	KODIAK						
KRAA	- Kitoi Bay	2,586,652	61,317	800		20,000	2,668,769
	KODIAK TOTALS	2,586,652	61,317	800		20,000	2,668,769
STATEWIDE TOTALS		34,840,033	4,491,961	854,110	84,067	1,015,919	41,286,090

Table 13.13. Summary of Sci/Ed. permitted salmon production in Alaska for 1991.

REGION / PERMITTEE	PROJECT TYPE	SPECIES	RELEASE NUMBER
SOUTHEAST			
Craig Elementary School	Classroom incubation	Coho	500
Gunnuk Creek Hatchery	Instream incubation	Steelhead	14,400
NSRAA (Aqua. Assoc.)	Instream incubation	Sockeye	400,000
NSRAA (Aqua. Assoc.)	Instream incubation	Chum	200,000
NSRAA (Aqua. Assoc.)	Instream incubation	Chum	800,000
NSRAA (Aqua. Assoc.)	Instream incubation	Coho	24,000
Petersburg High Scool	School Hatchery	Pink	80,000
Skagway City Schools	School Hatchery	Pink, Coho Chinook	100,000
SSRAA (Aqua. Assoc.)	Experiment	Chinook	30,000
USDA Forest Service	Stream Stocking	Coho	100,000
USDA Forest Service	Stream Stocking	Coho	5,500
USDA Forest Service	Stream Stocking	Coho	10,000
USDA Forest Service	Stream Stocking	Coho	168,000
USDA Forest Service	Stream Stocking	Coho	560,000
Walker/Ketchikan School	Class Science Project	Chinook	50
SOUTHCENTRAL			
Big Lake Elementary	Classroom incubation	Coho	250
Chugiak High Scool	Classroom incubation	Coho	250
Colony High Scool	Classroom incubation	Coho	250
Colony Middle School	Classroom incubation	Coho	250
Sand Lake School	Classroom incubation	Coho	250
Susitna Elementary	Classroom incubation	Coho	250
Girdwood Jr. High	Classroom incubation	Coho	1,000
Gruening Middle School	Classroom incubation	Coho	250
Homer High Scool	Classroom incubation	Pink	1,000
Homer Middle School	Classroom incubation	Pink	250
Houston Jr./Sr. High	Classroom incubation	Coho	250
Wasilla High School	Classroom incubation	Coho	250
Palmer High School	Classroom incubation	Coho	250
Pt. Graham Village	Hatchery Feasibility Study	Pink	200,000
Pt. Graham Village	Hatchery Feasibility Study	Pink	3,000,000
Nanwalek Traditional Council	Experimental Rearing	Sockeye	20,000
INTERIOR			
North Pole Middle School	School Hatchery	Chum	11,000
Delta/Greely Schools	Classroom incubation	Coho	11,200
WESTERN			
Main Elementary (Kodiak)	Classroom incubation	Coho	250
AEB School District	Instream incubation	Coho	16,800
St. George Island	Hatchery Feasibility Study	Pink	1,500,000
Sand Point School	School Hatchery	Coho & Pink	82,400
Unalaska City Schools	School Hatchery	Coho & Pink	52,000
AYK			
Galena School District	Classroom incubation	Coho	250
Kaltag City Schools	Classroom incubation	Coho	250
Koyukuk City Schools	Classroom incubation	Coho	250
Nulato City Schools	Classroom incubation	Coho	250
Nome-Beltz School	School Hatchery	Coho & Pink	50,000
	STATEWIDE TOTAL		7,441,850

CHAPTER 14

ALASKAN ENHANCEMENT PROGRAM

The statewide fisheries enhancement program continued to grow in 1991. More eggs were taken and fish released than ever before. More than 1.7 billion eggs (Table 14.1) were taken by hatchery crews, and 1.3 billion fish (Table 14.2) released. Pink salmon accounted for approximately 60% of the eggs taken and fish released, followed by chum salmon.

The 1991 returns (48.3 million fish) (Table 14.3; Figure 14.1) were slightly less than the 1990 (48.7 million fish) returns. In 1990 pink salmon accounted for 85% of the total enhanced fish returns; in 1991 pink salmon accounted for 79% of the return. In 1990 sockeye salmon accounted for 9% of the total enhanced fish return; in 1991 sockeye salmon accounted for 13%. This tradeoff between pink and sockeye salmon reflects the changing focus of the statewide enhancement program, away from the lower valued pink salmon to the higher valued sockeye salmon.

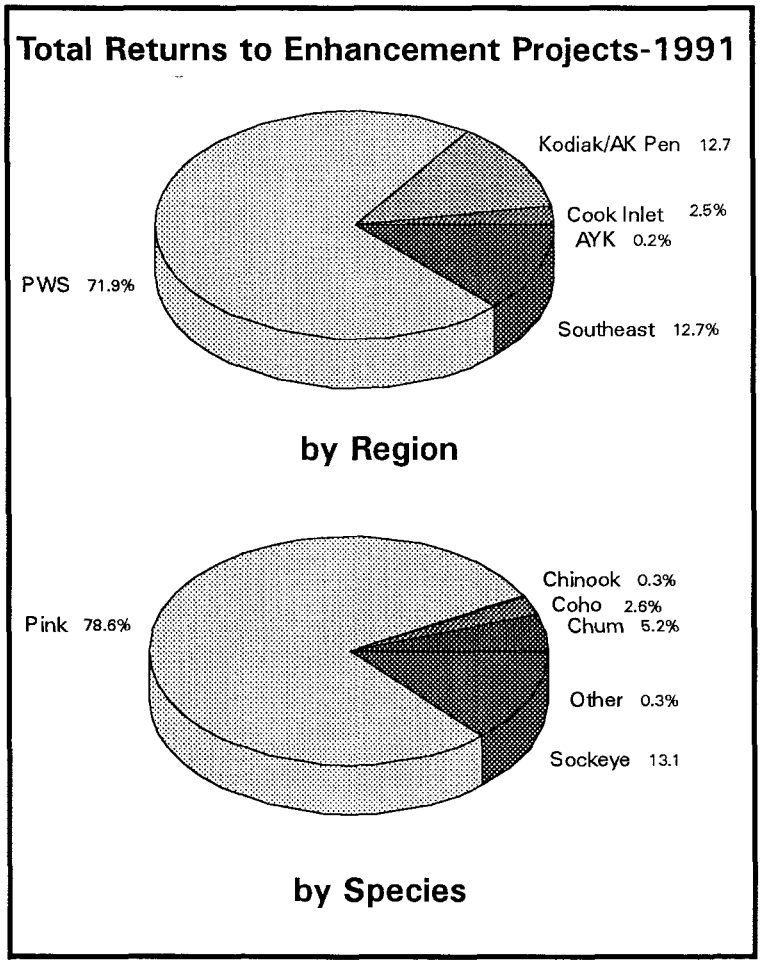

Figure 14.1.

Most (87%) of the 1991 pink salmon returns were to hatcheries in Prince William Sound. Thus, Prince William Sound accounted for 72% of all 1991 enhanced fish returns. Most of the sockeye salmon returns were to lake enrichment and fishpass projects in the Kodiak area.

In summary, the statewide salmon enhancement program contributed 30 million fish to the commercial fisheries and 367,000 fish to the sport fisheries. This production helps make Alaska's fisheries enhancement program the largest in North America, and the second largest in the world. These fish provide benefits directly to commercial, sport, subsistence, and personal-use fishermen, as well as provide indirect benefits to fish processors, tackle shops, etc. The enhancement program is tremendously successful and serves an important role in the economic diversification of Alaska.

Table 14.1. 1991 eggtakes from Alaskan hatcheries (combined PNP + FRED)

Region	Pink	Chum	Coho	Chinook	Sockeye	Other	TOTAL
ARCTIC/YUKON/KUSKOKWIM							
FRED	30,000	10,833,400				4,881,000	15,744,400
	30,000	10,833,400	0	0	0	4,881,000	15,744,400
COOK INLET							
FRED			2,951,000	2,480,500	25,712,000	6,782,000	37,925,500
PNP	37,400,000	4,020,000	810,000		12,970,000		55,200,000
	37,400,000	4,020,000	3,761,000	2,480,500	38,682,000	6,782,000	93,125,500
KODIAK & AK PENINSULA							
FRED	178,000,000	37,800,000	1,360,000		9,845,000		227,005,000
	178,000,000	37,800,000	1,360,000	0	9,845,000	0	227,005,000
PRINCE WILLIAM SOUND							
FRED				92,000	37,334,000		37,426,000
PNP	664,440,000	116,560,000	4,700,000	1,070,000	8,800,000		795,570,000
	664,440,000	116,560,000	4,700,000	1,162,000	46,134,000	0	832,996,000
SOUTHEAST							
FRED			1,090,000	6,036,000	12,322,000	134,600	19,582,600
PNP	129,020,000	320,960,000	10,610,000	8,920,000	5,700,000		475,210,000
	129,020,000	320,960,000	11,700,000	14,956,000	18,022,000	134,600	494,792,600
STATEWIDE TOTALS	1,008,890,000	490,173,400	21,521,000	18,598,500	112,683,000	11,797,600	1,663,663,500

Table 14.2. 1991 releases from Alaskan hatcheries (combined PNP + FRED)

Region	Pink	Chum	Coho	Chinook	Sockeye	Other	TOTAL
ARCTIC/YUKON/KUSKOKWIM							
FRED		7,365,000				2,255,841	9,620,841
	0	7,365,000	0	0	0	2,255,841	9,620,841
COOK INLET							
FRED	30,000,000		1,875,800	1,968,500	22,942,000	5,025,622	61,811,922
PNP		2,540,000	2,010,000		6,350,000		10,900,000
	30,000,000	2,540,000	3,885,800	1,968,500	29,292,000	5,025,622	72,711,922
KODIAK & AK PENINSULA							
FRED	127,648,000	4,900,000	525,000		4,564,000		137,637,000
	127,648,000	4,900,000	525,000	0	4,564,000	0	137,637,000
PRINCE WILLIAM SOUND							
FRED				26,000	26,240,600		26,266,600
PNP	603,520,000	78,450,000	3,220,000	590,000			685,780,000
	603,520,000	78,450,000	3,220,000	616,000	26,240,600	0	712,046,600
SOUTHEAST							
FRED		2,357,000	2,218,300	1,389,200	7,157,000	42,940	13,164,440
PNP	100,810,000	278,280,000	6,270,000	3,310,000	1,730,000		390,400,000
	100,810,000	280,637,000	8,488,300	4,699,200	8,887,000	42,940	403,564,440
STATEWIDE TOTALS	861,978,000	373,892,000	16,119,100	7,283,700	68,983,600	7,324,403	1,335,580,803

Table 14.3. 1991 estimated returns to Alaskan hatcheries (combined PNP + FRED)

	Pink					Chum					Coho				
Region	Commercial	Sport	Cost recovery	Other	Total	Commerci	Sport	Cost recovery	Other	Total	Commercial	Sport	Cost recovery	Other	Total
ARCTIC/YUKON/KUSKOKWIM															
FRED					0	20,000	100		11,700	31,800		15,000			15,000
	0	0	0	0	0	20,000	100	0	11,700	31,800	0	15,000	0	0	15,000
COOK INLET															
FRED	200,000	2,500		121,000	323,500	1,000			1,000	2,000	1,710	43,294		13,785	58,789
PNP					0	22,416		2,569	2,035	27,020	1,250	3,250	6,394	1,608	12,502
	200,000	2,500	0	121,000	323,500	23,416	0	2,569	3,035	29,020	2,960	46,544	6,394	15,393	71,291
KODIAK & AK PENINSULA															
FRED	1,406,700	200		432,961	1,839,861	31,700			43,300	75,000	9,800	2,200		17,250	29,250
	1,406,700	200	0	432,961	1,839,861	31,700	0	0	43,300	75,000	9,800	2,200	0	17,250	29,250
PRINCE WILLIAM SOUND															
FRED					0	137,129				137,129		10,000			10,000
PNP	20,896,436	32,500	10,325,787	1,793,270	33,047,993	100,448	50	12,660	142,276	255,434	76,104	10,350	53,166	7,930	147,550
	20,896,436	32,500	10,325,787	1,793,270	33,047,993	237,577	50	12,660	142,276	392,563	76,104	20,350	53,166	7,930	157,550
SOUTHEAST															
FRED	467,600	4,000		90,000	561,600	53,525			2,371	55,896	108,412	4,689		30,143	143,244
PNP	624,807	10,550	1,149,541	574,053	2,358,951	823,481	5,800	388,374	458,429	1,676,084	472,187	34,329	313,052	21,718	841,286
	1,092,407	14,550	1,149,541	664,053	2,920,551	877,006	5,800	388,374	460,800	1,731,980	580,599	39,018	313,052	51,861	984,530
TOTAL	23,595,543	49,750	11,475,328	3,011,284	38,131,905	1,189,699	5,950	403,603	661,111	2,260,363	669,463	123,112	372,612	92,434	1,257,621

Table 14.3. Continued.

	Chinook					Sockeye					Other					
Region	Commercial	Sport	Cost recovery	Other	Total	Commerci	Sport	Cost recovery	Other	Total	Commercial	Sport	Cost recovery	Other	Total	GRAND TOTAL
ARCTIC/YUKON/KUSKOKWIM																
FRED					0					0		68,000			68,000	114,800
	0	0	0	0	0	0	0	0	0	0	0	68,000	0	0	68,000	114,800
COOK INLET																
FRED	820	22,773		2,440	26,033	408,900	5,100		150,000	564,000		63,100		90	63,190	1,037,512
PNP					0	104,718		3,604	41,275	149,597					0	189,119
	820	22,773	0	2,440	26,033	513,618	5,100	3,604	191,275	713,597	0	63,100	0	90	63,190	1,226,631
KODIAK & AK PENINSULA																
FRED					0	2,870,632			1,333,603	4,204,235		1,400			1,400	6,149,746
	0	0	0	0	0	2,870,632	0	0	1,333,603	4,204,235	0	1,400	0	0	1,400	6,149,746
PRINCE WILLIAM SOUND																
FRED					0	602,700	111		104,789	707,600					0	854,729
PNP	184	70		1,693	1,947	422,562			37,312	459,874					0	33,912,798
	184	70	0	1,693	1,947	1,025,262	111	0	142,101	1,167,474	0	0	0	0	0	34,767,527
SOUTHEAST																
FRED	25,878	11,069		5,439	42,386	96,863	200		187,699	284,762					0	1,087,888
PNP	15,892	6,735	21,138	7,589	51,354	2,015		1,419	575	4,009					0	4,931,684
	41,770	17,804	21,138	13,028	93,740	98,878	200	1,419	188,274	288,771	0	0	0	0	0	6,019,572
TOTAL	42,774	40,647	21,138	17,161	121,720	4,508,390	5,411	5,023	1,855,253	6,374,077	0	132,500	0	90	132,590	48,278,276

FRED	6,443,369	253,736	0	2,547,570	9,244,675
PNP	23,562,500	103,634	12,277,704	3,089,763	39,033,601
TOTAL	30,005,869	357,370	12,277,704	5,637,333	48,278,276

ACKNOWLEDGMENTS

The editors wish to acknowledge the efforts of many people within the FRED Division that have contributed to this report. First, many area and hatchery personnel have assembled data reports that are the basis of this document. Second, a smaller number of individuals have compiled information from field reports and made their syntheses available. The following contributors had a great impact on the preparation of this report:

Report Section	Contributor
Production Report	William J. Hauser, Ph.D. Kenneth A. Leon, Ph.D.
Technology and Development	Robert D. Burkett, Ph.D.
Private Nonprofit Hatcheries	Steven G. McGee
Mariculture	James O. Cochran

Finally, a smaller group has assisted with editing and manuscript preparation. Thanks to Steve McGee for editing much of the manuscript, and to Katherine Aschaffenburg for her able assistance in editing and manuscript preparation.

GLOSSARY OF ACRONYMS

ACMP	Alaska Coastal Management Program
ADF&G	Alaska Department of Fish and Game
AMP	Annual Management Plan
ASGA	Alaska Shellfish Grower's Association
AYK	Arctic-Yukon-Kuskokwim Region
BDC	Broodstock Development Center, Fort Richardson Hatchery
BKD	Bacterial Kidney Disease (fish disease)
CIAA	Cook Inlet Aquaculture Association
CIF	Central Incubation Facility
DCED	Alaska Department of Commerce and Economic Development
DEC	Alaska Department of Environmental Conservation
DGC	Division of Governmental Coordination, Governor's Office
DNR	Alaska Department of Natural Resources
DOT/PF	Alaska Department of Transportation and Public Facilities
ELISA	Enzyme-Linked Immunoabsorbent Assay (pathology)
FAT	Fluorescent Antibody Test (pathology)
FRED	Fisheries Rehabilitation, Enhancement and Development Division, ADF&G
FY	State Fiscal Year (1 July-30 June)
FTP	Fish Transport Permit
GSI	Genetic Stock Identification
IAMWG	Interagency Mariculture Work Group
IHN	Infectious Hematopoietic Necrosis Virus (fish disease)
ISER	University of Alaska-Anchorage, Institute of Social and Economic Research
KRAA	Kodiak Regional Aquaculture Association
MTC	Mariculture Technical Center
NMFS	National Marine Fisheries Service
NRDA	Natural Resource Damage Assessment (*Exxon Valdez* oil spill)
NSRAA	Northern Southeast Regional Aquaculture Association
OSIAR	Oil Spill Impact, Assessment, and Restoration Division, ADF&G
PIT	Passive Induced Transponder Tags
PNFHPC	Pacific Northwest Fish Health Protection Committee
PNP	Private Nonprofit
PWS/CR RPT	Prince William Sound/Copper River Regional Planning Team
PWSAC	Prince William Sound Aquaculture Corporation
RPT	Regional Planning Team
SKIF	Streams, Kids and Fish Program (Municipality of Anchorage)
SSRAA	Southern Southeast Regional Aquaculture Association
UAF	University of Alaska-Fairbanks
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USF&WS	U.S. Fish and Wildlife Service
VHS	Viral Hemorrhagic Septicemia Virus (fish disease)
W-B	Wallop-Breaux (federal aid funding)
WLN	Western Library Network
WRAC	Western Regional Aquaculture Consortium

APPENDICES

APPENDIX 1

Salmonids Stocked by FRED Division in 1991

Appendix 1. Salmonids stocked by FRED Division in 1991

1/16/92: Includes releases as of 1 December 1991

Stocking location	Area	Species	Hatchery	Broodstock	Lifestage	Number stocked	Average weight (gm)
BACKDOWN L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	600	9.420
BATHING BEAUTY	AYK	ARCTIC CHAR	CLEAR H	ALEKNAGIK L	CATCHABLE	217	316.000
BATHING BEAUTY	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	700	7.440
BIRCH L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	18,600	11.045
BOLIO L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	14,000	11.060
BRODE L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	500	9.420
CHENA L	AYK	ARCTIC CHAR	CLEAR H	ALEKNAGIK L	BROODSTOCK	36	2134.000
CHENA L	AYK	ARCTIC CHAR	CLEAR H	ALEKNAGIK L	CATCHABLE	944	753.333
CHENA L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	SUBCATCH	16,900	35.600
DICK'S POND	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	1,000	9.420
DUCK POND #1	AYK	ARCTIC CHAR	CLEAR H	ALEKNAGIK L	CATCHABLE	100	761.000
DUCK POND #2	AYK	ARCTIC CHAR	CLEAR H	ALEKNAGIK L	CATCHABLE	120	761.000
FUN FISH DAY	AYK	ARCTIC CHAR	CLEAR H	ALEKNAGIK L	CATCHABLE	18	761.000
GRAYLING L	AYK	ARCTIC CHAR	CLEAR H	ALEKNAGIK L	CATCHABLE	434	738.000
HARDING L	AYK	ARCTIC CHAR	CLEAR H	ALEKNAGIK L	CATCHABLE	1,566	761.000
HARDING L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	106,050	11.050
HARDING L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	SUBCATCH	171,376	37.717
HIDDEN L(FAIR)	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	1,800	7.440
KENS POND	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	1,000	9.420
LAST L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	400	9.420
LOST L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	30,800	8.040
MANCHU L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	2,900	7.440
OLD BEAVER L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	1,000	9.420
PLACK ROAD PIT	AYK	ARCTIC CHAR	CLEAR H	ALEKNAGIK L	CATCHABLE	100	761.000
QUARTZ L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	75,000	10.550
RANGEVIEW L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	900	9.420
RED DOG MINE	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	1,000	3.950
SANSING L	AYK	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	SUBCATCH	300	100.260
WAINWRIGHT #6	AYK	ARCTIC CHAR	CLEAR H	ALEKNAGIK L	CATCHABLE	81	761.000
BENKA L	NCI	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	12,300	7.670
CAMPBELL PT L	NCI	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	SUBCATCH	1,000	104.400
CLUNIE L	NCI	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	SUBCATCH	1,250	104.400
GWEN L	NCI	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	SUBCATCH	1,250	104.400
IRENE L	NCI	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	3,600	7.670
MARION L	NCI	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	FINGERLING	11,300	7.670
MIRROR L	NCI	ARCTIC CHAR	CLEAR H	CLEAR (ALEK)	SUBCATCH	1,250	104.400
CROOKED CR	CCI	CHINOOK	ELMENDORF H	CROOKED CR	SMOLT	239,653	18.380
LOWELL CR	CCI	CHINOOK	ELMENDORF H	CROOKED CR	SMOLT	93,200	18.900
SEWARD LAGOON	CCI	CHINOOK	CROOKED CR H	KASILOF R	SMOLT	273,500	26.000
SEWARD LAGOON	CCI	CHINOOK	ELMENDORF H	CROOKED CR	SMOLT	99,665	18.840
CRYSTAL CR	CSE	CHINOOK	CRYSTAL LAKE H	CRYSTAL CR	SMOLT	434,114	16.403
EARL WEST COVE	CSE	CHINOOK	CRYSTAL LAKE H	CRYSTAL CR	SMOLT	402,472	14.915

Appendix 1. Salmonids stocked by FRED Division in 1991

1/16/92: Includes releases as of 1 December 1991

Stocking location	Area	Species	Hatchery	Broodstock	Lifestage	Number stocked	Average weight (gm)
ISLAND L (KOD)	KOD	CHINOOK	ELMENDORF H	CROOKED CR	SMOLT	22,257	19.060
MISSION L	KOD	CHINOOK	ELMENDORF H	CROOKED CR	SMOLT	20,111	19.060
HALIBUT COVE LG	LCI	CHINOOK	ELMENDORF H	CROOKED CR	SMOLT	92,363	21.530
HOMER SPIT	LCI	CHINOOK	ELMENDORF H	CROOKED CR	SMOLT	190,915	19.540
NINILCHIK R	LCI	CHINOOK	FT RICHARDSON	NINILCHIK R	SMOLT	87,992	12.000
SELDOVIA HARBOR	LCI	CHINOOK	ELMENDORF H	CROOKED CR	SMOLT	91,592	21.230
BEACH L	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	3,076	103.000
CAMPBELL PT L	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	1,617	103.000
CHENEY L	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	5,206	111.000
CLUNIE L	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	4,232	111.000
DECEPTION CR	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	SMOLT	391,669	12.117
DELONG L	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	5,068	103.000
EAGLE RIVER	NCI	CHINOOK	ELMENDORF H	SHIP CR	SMOLT	102,100	17.400
GREEN L	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	1,007	103.000
GWEN L	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	2,090	111.000
HILLBERG L	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	512	103.000
JEWEL L	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	7,027	107.000
MIRROR L	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	4,981	103.000
OTTER L (FT R)	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	7,314	111.000
SAND L	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	10,014	103.000
SHIP CR	NCI	CHINOOK	ELMENDORF H	SHIP CR	SMOLT	211,268	16.960
SPRING L	NCI	CHINOOK	FT RICHARDSON	WILLOW CR	CATCHABLE	516	111.000
AUKE BAY CR	NSE	CHINOOK	SNETTISHAM H	CRYSTAL CR	SMOLT	147,055	15.950
FISH CR (JNO)	NSE	CHINOOK	SNETTISHAM H	CRYSTAL CR	SMOLT	150,246	22.260
SHEEP CR	NSE	CHINOOK	SNETTISHAM H	CRYSTAL CR	SMOLT	100,543	27.600
MONSOON L	PWS	CHINOOK	GULKANA II H	GULKANA E FORK	EMERGENT F	26,209	.650
BEHM CANAL	SSE	CHINOOK	DEER MOUNTAIN	KETCHIKAN CR	SMOLT	5,853	25.000
BIG SALT L	SSE	CHINOOK	DEER MOUNTAIN	KETCHIKAN CR	SMOLT	25,041	19.800
KETCHIKAN CR	SSE	CHINOOK	DEER MOUNTAIN	KETCHIKAN CR	SMOLT	79,064	21.277
THOMAS BASIN	SSE	CHINOOK	DEER MOUNTAIN	KETCHIKAN CR	SMOLT	19,172	24.670
THORNE BAY	SSE	CHINOOK	DEER MOUNTAIN	KETCHIKAN CR	SMOLT	24,400	19.000
RUSSELL CR	AKP	CHUM	RUSSELL CR H	RUSSELL CR	FINGERLING	4,900,000	1.100
NOATAK R	AYK	CHUM	SIKUSUILAQ H	NOATAK R	FED FRY	7,365,874	.408
LIMESTONE CR	NSE	CHUM	SNETTISHAM H	SNETTISHAM INLT	FED FRY	2,356,933	1.220
BIRCH L	AYK	COHO	BIG LAKE H	BIG L (BIG L)	FINGERLING	40,303	.990
CHENA L	AYK	COHO	BIG LAKE H	BIG L (BIG L)	FINGERLING	16,364	.990
QUARTZ L	AYK	COHO	BIG LAKE H	BIG L (BIG L)	FINGERLING	151,785	1.010

Appendix 1. Salmonids stocked by FRED Division in 1991

1/16/92: Includes releases as of 1 December 1991

Stocking location	Area	Species	Hatchery	Broodstock	Lifestage	Number stocked	Average weight (gm)
SOUTH JAN L	AYK	COHO	BIG LAKE H	BIG L (BIG L)	FINGERLING	20,000	.990
ARC L	CCI	COHO	CROOKED CR H	CROOKED CR	FINGERLING	5,000	2.000
CENTENNIAL L	CCI	COHO	CROOKED CR H	CROOKED CR	FINGERLING	5,000	2.000
CROOKED CR	CCI	COHO	CROOKED CR H	CROOKED CR	SMOLT	72,123	24.100
ENGINEER L-STER	CCI	COHO	CROOKED CR H	CROOKED CR	FINGERLING	46,000	2.000
LOWELL CR	CCI	COHO	ELMENDORF H	BEAR L	SMOLT	30,400	21.450
ROGUE L	CCI	COHO	CROOKED CR H	CROOKED CR	FINGERLING	2,000	2.000
SCOUT L	CCI	COHO	CROOKED CR H	CROOKED CR	FINGERLING	19,000	2.000
SEWARD LAGOON	CCI	COHO	ELMENDORF H	BEAR L	SMOLT	119,057	19.345
UNION L	CCI	COHO	CROOKED CR H	CROOKED CR	FINGERLING	15,000	2.000
CRYSTAL CR	CSE	COHO	CRYSTAL LAKE H	CRYSTAL CR	EMERGENT F	351,810	.290
CRYSTAL CR	CSE	COHO	CRYSTAL LAKE H	CRYSTAL CR	FED FRY	59,766	.725
CRYSTAL CR	CSE	COHO	CRYSTAL LAKE H	CRYSTAL CR	SMOLT	78,810	14.010
CRESCENT L(KOD)	KOD	COHO	KITOI H	BIG KITOI CR	FINGERLING	191,416	1.100
DARK L	KOD	COHO	KITOI H	BIG KITOI CR	FINGERLING	7,500	1.240
HIDDEN L (KOD)	KOD	COHO	KITOI H	BIG KITOI CR	FINGERLING	250,889	1.175
ISLAND L (KOD)	KOD	COHO	KITOI H	BIG KITOI CR	FINGERLING	20,500	1.240
KALSIN L	KOD	COHO	KITOI H	BIG KITOI CR	FINGERLING	19,350	1.240
MAYFLOWER L	KOD	COHO	KITOI H	BIG KITOI CR	FINGERLING	6,500	1.240
MISSION L	KOD	COHO	KITOI H	BIG KITOI CR	FINGERLING	12,700	1.240
ORBIN L	KOD	COHO	KITOI H	BIG KITOI CR	FINGERLING	5,080	1.240
PONY L	KOD	COHO	KITOI H	BIG KITOI CR	FINGERLING	2,400	1.240
POTATOE L	KOD	COHO	KITOI H	BIG KITOI CR	FINGERLING	9,500	1.240
CARIBOU L (HOM)	LCI	COHO	CROOKED CR H	CROOKED CR	FINGERLING	180,000	2.000
HOMER SPIT	LCI	COHO	ELMENDORF H	BEAR L	SMOLT	100,029	22.635
SELDOVIA L	LCI	COHO	CROOKED CR H	CROOKED CR	FINGERLING	50,000	2.000
BENKA L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	37,073	7.850
CASWELL CR	NCI	COHO	FT RICHARDSON	CASWELL CR	SMOLT	155,529	18.500
CHRISTENSEN L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	35,708	6.530
COTTONWOOD CR	NCI	COHO	BIG LAKE H	BIG L (BIG L)	SMOLT	72,000	25.300
DELONG L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	8,593	8.290
ECHO L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	6,960	5.810
FINGER L(ANAD)	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	72,420	5.700
FISH CR	NCI	COHO	BIG LAKE H	BIG L (BIG L)	SMOLT	82,589	25.133
HILLBERG L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	6,112	9.080
JEWEL L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	8,593	8.290
JUNCTION L-PALM	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	2,200	5.810
KLAIRE L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	6,300	5.810
KNIK L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	5,000	5.700
L SUSITNA R	NCI	COHO	FT RICHARDSON	L SUSITNA R	SMOLT	88,675	23.400
LOON L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	26,495	5.700
MATANUSKA L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	6,300	5.600
MEADOW CR	NCI	COHO	BIG LAKE H	BIG L (BIG L)	SMOLT	400	25.300

Appendix 1. Salmonids stocked by FRED Division in 1991

1/16/92: Includes releases as of 1 December 1991

Stocking location	Area	Species	Hatchery	Broodstock	Lifestage	Number stocked	Average weight (gm)
MEMORY L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	17,660	5.700
NANCY L	NCI	COHO	FT RICHARDSON	L SUSITNA R	SMOLT	189,087	22.367
ROCKY L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	13,500	5.700
SHIP CR	NCI	COHO	ELMENDORF H	SHIP CR	SMOLT	57,800	23.820
SPRING L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	4,000	9.080
TRIANGLE L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	6,268	9.080
VICTOR L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	6,700	5.810
WASILLA CR	NCI	COHO	BIG LAKE H	BIG L (BIG L)	SMOLT	69,500	25.050
WOLF L	NCI	COHO	ELMENDORF H	BEAR L	FINGERLING	12,470	5.600
INDIAN L	NSE	COHO	SNETTISHAM H	SNETTISHAM INLT	FED FRY	171,400	.500
SECOND L	NSE	COHO	SNETTISHAM H	SNETTISHAM INLT	FED FRY	48,215	.600
KETTLE L	PWS	COHO	BIG LAKE H	BIG L (BIG L)	FINGERLING	2,970	.990
PEANUT L	PWS	COHO	BIG LAKE H	BIG L (BIG L)	FINGERLING	3,861	.990
BEHM CANAL	SSE	COHO	DEER MOUNTAIN	REFLECTION L	SMOLT	5,411	25.000
CABLE CR	SSE	COHO	KLAWOCK H	CABLE CR	SMOLT	80,386	8.200
KETCHIKAN CR	SSE	COHO	DEER MOUNTAIN	REFLECTION L	SMOLT	28,992	17.000
KLAWOCK L	SSE	COHO	KLAWOCK H	KLAWOCK R	SMOLT	1,239,754	21.000
KLAWOCK R	SSE	COHO	KLAWOCK H	KLAWOCK R	SMOLT	69,987	32.510
MARGARET L	SSE	COHO	DEER MOUNTAIN	REFLECTION L	SMOLT	25,391	14.330
REFLECTION L	SSE	COHO	DEER MOUNTAIN	REFLECTION L	SMOLT	6,406	17.400
WARD L	SSE	COHO	DEER MOUNTAIN	REFLECTION L	SMOLT	50,920	12.430
"J" L	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	3,000	5.400
180 PARKS HWY	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	1,000	5.380
31 MILE PIT	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	10,000	.016
81 MILE PIT	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	600	4.930
BATHING BEAUTY	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	1,000	4.930
BIG L (FAIR)	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	1,000	5.400
BIRCH L	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	40,000	4.930
BOLIO L	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	1,000	4.930
CHENA HS #30.9	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	650	5.420
CHENA HS #32.9	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	5,600	2.940
CHENA HS #45.5	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	550	5.420
CHENA HS #47.9	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	550	5.420
CHENA L	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	13,000	4.930
DUCK POND #1	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	CATCHABLE	100	117.000
DUCK POND #2	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	CATCHABLE	130	117.000
FUN FISH DAY	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	BROODSTOCK	25	252.000
GRAYLING L	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	CATCHABLE	500	117.000
GRAYLING L	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	1,000	4.930
HARDING L	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	CATCHABLE	160	117.000
HARDING L	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	697,178	.016
HARDING L	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	43,397	5.280
HIDDEN L(FAIR)	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	3,600	5.400

Appendix 1. Salmonids stocked by FRED Division in 1991

1/16/92: Includes releases as of 1 December 1991

Stocking location	Area	Species	Hatchery	Broodstock	Lifestage	Number stocked	Average weight (gm)
JOHNSON PIT #1	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	1,000	4.930
LONG POND	AYK	GRAYLING	CLEAR H	CLEAR HATCHERY	EMERGENT F	95,900	.018
LONG POND	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	400	5.200
LUKE L	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	600	5.400
PLACK ROAD PIT	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	CATCHABLE	255	117.000
ROUND POND	AYK	GRAYLING	CLEAR H	CLEAR HATCHERY	EMERGENT F	15,000	.018
ROUND POND	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	700	5.200
SHEEFISH L	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	800	4.930
STEESE HWY 29.5	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	950	5.420
STEESE HWY 30.6	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	250	5.420
STEESE HWY 31.6	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	400	5.420
STEESE HWY 33.0	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	700	5.420
STEESE HWY 33.5	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	500	5.420
STEESE HWY 34.6	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	600	5.420
STEESE HWY 35.8	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	250	5.420
STEESE HWY 36.6	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	950	5.420
STEESE HWY 39.2	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	1,000	5.420
WAINWRIGHT #6	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	CATCHABLE	154	117.000
WALDEN POND	AYK	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	4,000	5.380
AUREL L	KOD	GRAYLING	CLEAR H	CLEAR HATCHERY	EMERGENT F	20,000	.018
CASCADE L	KOD	GRAYLING	CLEAR H	CLEAR HATCHERY	EMERGENT F	10,000	.018
CICELY L	KOD	GRAYLING	CLEAR H	CLEAR HATCHERY	EMERGENT F	10,000	.018
HEITMAN L	KOD	GRAYLING	CLEAR H	CLEAR HATCHERY	EMERGENT F	30,000	.018
17 MILE L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	10,000	5.060
BEACH L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	4,000	5.380
BRUCE L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	2,700	5.060
CANOE L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	21,200	.016
CANOE L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	4,200	5.060
FARMER L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	2,100	5.060
FINGER L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	18,100	5.060
KEPLER-BRADLY L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	5,800	5.060
KNIK L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	5,000	5.060
LOBERG L (JUNC)	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	1,100	5.060
LONG L (KB)	NCI	GRAYLING	CLEAR H	CLEAR HATCHERY	EMERGENT F	184,000	.017
LONG L (KB)	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	20,000	5.060
LONG L (MI86)	NCI	GRAYLING	CLEAR H	CLEAR HATCHERY	EMERGENT F	120,000	.018
LOWER FIRE L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	7,000	5.380
MATANUSKA L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	6,100	5.060
MEIRS L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	16,700	.016
MEIRS L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	3,400	5.060
WILLOW L	NCI	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	14,300	5.060
BEAVER L(SITKA)	NSE	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	15,000	.016
SWAN L (SIT)	NSE	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	15,000	.016
28.5 MI L	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	10,000	.016

Appendix 1. Salmonids stocked by FRED Division in 1991

Stocking location	Area	Species	Hatchery	Broodstock	Lifestage	Number stocked	Average weight (gm)
ALAGANIK SL L	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	10,000	.016
CARIBOU L (PWS)	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	10,000	5.200
JUNCTION L	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	3,500	.015
MOOSE CR	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	50,000	.020
PIPELINE L#1	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	10,000	.016
PIPELINE L#4	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	10,000	.016
SHERIDAN DIKE 1	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	10,000	.016
SHERIDAN DIKE 2	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	10,000	.016
SQUIRREL CR L	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	5,000	.016
THOMPSON L	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	10,000	.016
TOLSONA L	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	EMERGENT F	80,000	.020
TOLSONA L	PWS	GRAYLING	CLEAR H	MOOSE L (GLEN)	FINGERLING	10,000	5.200
CHET L	AYK	LAKE TROUT	CLEAR H	PAXSON L	FINGERLING	1,800	3.600
COAL MINE #5	AYK	LAKE TROUT	CLEAR H	PAXSON L	FINGERLING	2,600	3.600
CRAIG L	AYK	LAKE TROUT	CLEAR H	PAXSON L	FINGERLING	3,500	3.900
FOUR MILE L	AYK	LAKE TROUT	CLEAR H	PAXSON L	FINGERLING	20,000	3.900
LONG L (FBK)	AYK	LAKE TROUT	CLEAR H	PAXSON L	FINGERLING	7,677	3.900
N TWIN L	AYK	LAKE TROUT	CLEAR H	PAXSON L	FINGERLING	2,000	3.800
NICKEL L	AYK	LAKE TROUT	CLEAR H	PAXSON L	FINGERLING	1,000	3.600
OLD BEAVER L	AYK	LAKE TROUT	CLEAR H	PAXSON L	FINGERLING	2,000	3.900
PAUL'S POND	AYK	LAKE TROUT	CLEAR H	PAXSON L	FINGERLING	1,000	3.600
RAPID L	AYK	LAKE TROUT	CLEAR H	PAXSON L	FINGERLING	1,000	3.900
14 MILE L	PWS	LAKE TROUT	CLEAR H	PAXSON L	FINGERLING	17,961	7.760
RUSSELL CR	AKP	PINK	RUSSELL CR H	RUSSELL CR	EMERGENT F	3,500,000	.250
KITOI BAY	KOD	PINK	KITOI H	BIG KITOI CR	EMERGENT F	2,604,681	.280
KITOI BAY	KOD	PINK	KITOI H	BIG KITOI CR	FED FRY	121,543,338	.600
HALIBUT COVE LG	LCI	PINK	TUTKA BAY H	TUTKA CR	EMERGENT F	6,039,062	.220
HOMER SPIT	LCI	PINK	TUTKA BAY H	TUTKA CR	EMERGENT F	303,826	.220
TUTKA CR	LCI	PINK	TUTKA BAY H	TUTKA CR	EMERGENT F	23,657,112	.220
BACKDOWN L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	600	1.700
BIRCH L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	SUBCATCH	25,153	22.900
BLACK RAPIDS L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	2,839	2.200
BLUFF CABIN	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	14,400	2.000
BOLIO L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,000	1.700
BULLWINKLE L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	800	1.700
CHENA HS #45.5	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,000	1.800
CHENA HS #47.9	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	600	1.800
CHENA L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	26,976	102.900
CHET L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,000	1.700

Appendix 1. Salmonids stocked by FRED Division in 1991

1/16/92: Includes releases as of 1 December 1991

Stocking location	Area	Species	Hatchery	Broodstock	Lifestage	Number stocked	Average weight (gm)
CRAIG L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	4,086	2.000
DERBY-FAIRBANKS	AYK	RAINBOW	FT RICHARDSON	BIG L (BIG L)	BROODSTOCK	252	453.000
DERBY-FAIRBANKS	AYK	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	270	85.000
DOC L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	600	1.700
DONNA L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	11,600	2.000
DONNELLY L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,000	1.700
DUNE L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	10,000	1.600
FOREST L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	7,000	1.900
FOUR MILE L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	19,983	1.700
GESKAMINA L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	20,000	1.600
GHOST L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,000	1.700
HANGER PIT	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,300	1.600
HARDING L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	173,800	1.700
HARDING L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	SUBCATCH	10,530	20.000
HIDDEN L(FAIR)	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	4,000	1.900
JAN L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	4,348	1.700
KENS POND	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,000	1.700
KOOLE L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	30,047	1.900
L DONNA L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	9,400	2.000
L HARDING L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,600	1.800
LES'S L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	SUBCATCH	750	10.100
LISA L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	10,000	2.000
MARK L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	4,000	1.700
MONTE L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	15,000	1.900
N TWIN L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	4,000	1.700
NICKEL L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,000	1.700
NO MERCY L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,500	1.700
OLNES POND	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,600	1.800
OUTBOARD PIT	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	16,000	2.200
PILEDRIVE SL-SR	AYK	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	25,143	74.250
QUARTZ L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	152,000	2.000
QUARTZ L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	SUBCATCH	42,716	22.600
RAINBOW L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	15,000	1.900
RED DOG MINE	AYK	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	100	60.000
ROBERTSON L #2	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,600	1.700
ROCKHOUND L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	300	1.700
S JANS L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	20,000	1.400
S JOHNSON L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	681	2.000
S TWIN L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	8,000	1.700
SPENCER L	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	5,000	1.800
STEESE HWY 29.5	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,000	1.800
STEESE HWY 33.0	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	800	1.800
STEESE HWY 34.6	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	350	1.800
STEESE HWY 36.6	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,000	1.800
STEESE HWY 39.2	AYK	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,000	1.800
WALDEN POND	AYK	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	2,016	93.000
CABIN L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	15,000	1.500

Appendix 1. Salmonids stocked by FRED Division in 1991

1/16/92: Includes releases as of 1 December 1991

Stocking location	Area	Species	Hatchery	Broodstock	Lifestage	Number stocked	Average weight (gm)
CECILE L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	2,000	1.500
COOPER L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FED FRY	250,000	.100
DERBY-SOLDOTNA	CCI	RAINBOW	FT RICHARDSON	SWANSON R	BROODSTOCK	705	637.500
DOUGLAS L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	18,000	1.500
JEROME L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,000	1.800
JOHNSON L-KASI	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	17,000	1.400
LONGMARE L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	34,000	1.500
MERIDIAN L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	4,000	1.800
PORTAGE L	CCI	RAINBOW	FT RICHARDSON	BIG L (BIG L)	BROODSTOCK	71	908.000
PORTAGE L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	5,499	95.867
QUINTIN L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,000	1.400
RAINBOW L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	5,000	1.500
SPORT L	CCI	RAINBOW	FT RICHARDSON	BIG L (BIG L)	BROODSTOCK	352	575.000
SPORT L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	15,000	1.400
STORMY L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	50,000	1.500
U SUMMIT L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	64,043	1.400
VAGT L	CCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	9,000	1.800
ABERCROMBIE L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,700	.500
AUREL L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,000	.500
BIG L (KOD)	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,600	.500
BULL L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	2,000	.500
CAROLINE L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,400	.500
CASCADE L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,300	.500
CHIGNIK R	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	5,000	.500
CICELY L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,150	.500
DOLGOI L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	5,150	.500
DRAGONFLY L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,500	.500
HEITMAN L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,250	.500
JUPITER L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,600	.500
LEE L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	2,800	.500
LILLY L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	900	.500
LONG L (KOD)	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,600	.500
LUPINE L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,600	.500
MARGARET L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,700	.500
SATURN L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	2,400	.500
TANIGNAK L	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	6,000	.500
TWIN L (KOD)	KOD	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	4,000	.500
"X" L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	20,226	1.700
"Y" L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,990	2.100
17 MILE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	10,000	1.500
APU LAKE	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	2,506	94.800
BARLEY L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,720	1.600
BEACH L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	BROODSTOCK	455	908.000
BEACH L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	4,042	92.700
BEAR PAW L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	4,900	2.100
BEAR PAW L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	SUBCATCH	3,600	4.000

Appendix 1. Salmonids stocked by FRED Division in 1991

1/16/92: Includes releases as of 1 December 1991

Stocking location	Area	Species	Hatchery	Broodstock	Lifestage	Number stocked	Average weight (gm)
BEVERLY L	NCI	RAINBOW	FT RICHARDSON	BIG L (BIG L)	FINGERLING	4,200	1.000
BIG L (BIG L)	NCI	RAINBOW	FT RICHARDSON	BIG L (BIG L)	FINGERLING	462,197	1.700
BIG NO LUCK	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	6,845	1.900
BLODGETT L	NCI	RAINBOW	FT RICHARDSON	BIG L (BIG L)	FINGERLING	5,760	1.000
CAMPBELL CR	NCI	RAINBOW	FT RICHARDSON	SWANSON R	BROODSTOCK	335	250.000
CAMPBELL CR	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	5,093	92.200
CAMPBELL PT L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	BROODSTOCK	100	908.000
CAMPBELL PT L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	5,094	92.150
CARPENTER L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	17,718	1.600
CHENEY L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	BROODSTOCK	453	908.000
CHENEY L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	7,050	98.933
CHESTER CR	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	2,458	93.000
CLUNIE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	5,076	86.500
COYOTE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	500	96.800
CRYSTAL L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	13,170	1.800
DAWN L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	2,360	1.600
DELONG L	NCI	RAINBOW	FT RICHARDSON	BIG L (BIG L)	BROODSTOCK	806	905.333
DELONG L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	7,429	97.000
DERBY POND	NCI	RAINBOW	FT RICHARDSON	SWANSON R	BROODSTOCK	700	462.500
DIAMOND L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	13,899	1.700
ECHO L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	2,021	96.800
EKLUTNA L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FED FRY	2,405,416	.127
FINGER L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	36,592	1.700
FLORENCE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	5,460	1.800
GOLF COURSE L	NCI	RAINBOW	FT RICHARDSON	BIG L (BIG L)	BROODSTOCK	3	681.000
GOLF COURSE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	22	83.000
GREEN L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	2,048	94.150
GWEN L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	3,316	90.750
HILLBERG L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	1,557	94.150
HONEYBEE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	5,800	1.900
HORSESHOE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,000	.500
IRENE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	2,059	96.800
JEWEL L	NCI	RAINBOW	FT RICHARDSON	BIG L (BIG L)	BROODSTOCK	1,417	735.250
JEWEL L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	11,533	98.250
KALMBACK L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	12,556	1.700
KASHWITNA L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	5,200	2.100
KEPLER-BRADLY L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	9,905	105.000
KNIK L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	4,155	94.000
L LONELY L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	5,600	1.800
LAKE OTIS	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	1,566	88.300
LALEN L	NCI	RAINBOW	FT RICHARDSON	BIG L (BIG L)	FINGERLING	9,190	1.000
LOBERG L (JUNC)	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	1,053	96.800
LONG L (KB)	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	14,728	1.650
LORRAINE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	2,871	1.600
LOWER FIRE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	BROODSTOCK	465	908.000
LOWER FIRE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	5,036	90.200
LUCILLE L	NCI	RAINBOW	FT RICHARDSON	BIG L (BIG L)	FINGERLING	42,562	1.000
LYNNE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	7,000	1.900

Appendix 1. Salmonids stocked by FRED Division in 1991

1/16/92: Includes releases as of 1 December 1991

Stocking location	Area	Species	Hatchery	Broodstock	Lifestage	Number stocked	Average weight (gm)
MARION L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	11,302	1.700
MATANUSKA L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	7,731	105.000
MATANUSKA L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	24,633	1.700
MIRROR L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	BROODSTOCK	450	908.000
MIRROR L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	7,391	90.200
MORVO L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	17,321	1.800
N FRIEND L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,885	2.100
OTTER L (FT R)	NCI	RAINBOW	FT RICHARDSON	SWANSON R	BROODSTOCK	626	1017.500
OTTER L (FT R)	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	9,906	100.875
PRATOR L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	2,250	2.100
PRATOR L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	SUBCATCH	10,570	4.000
RAVINE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	2,500	1.500
REED L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,900	1.600
S FRIEND L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	2,785	2.100
SAND L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	BROODSTOCK	100	908.000
SAND L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	5,125	93.800
SEYMOUR L	NCI	RAINBOW	FT RICHARDSON	BIG L (BIG L)	FINGERLING	22,900	1.000
SIX MILE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	800	96.800
SLIPPER L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	515	96.800
SLIVER L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	2,000	2.000
SOUTH ROLLY L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	10,770	1.900
SUNDI L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	1,500	106.000
TAKU CAMPBELL L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	BROODSTOCK	103	908.000
TAKU CAMPBELL L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	4,139	95.700
THOMPSON L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	2,017	106.000
TIGGER L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,890	2.100
TRIANGLE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	984	92.650
TWIN ISLAND L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	15,181	1.900
U SIX MILE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	696	88.500
VERA L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	11,050	1.800
VISNAW L	NCI	RAINBOW	FT RICHARDSON	BIG L (BIG L)	FINGERLING	13,070	1.000
WALBY L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	5,389	1.600
WEINER L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	4,140	1.500
WISHBONE L	NCI	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	10,569	1.750
BUFFALO L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	500	95.000
BUFFALO L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	800	1.400
JACK L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	1,000	.500
JANS L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	5,922	2.200
MIRROR L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	500	95.000
MIRROR L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	9,000	1.400
OLD ROAD L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	250	95.000
PEANUT L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	2,400	1.400
ROUND L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	250	95.000
RUTH L (GLEN)	PWS	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	1,052	135.000
SCULPIN L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	28,000	1.400
SQUIRREL CR L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	CATCHABLE	600	95.000
TINY L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	500	1.400

Appendix 1. Salmonids stocked by FRED Division in 1991

1/16/92: Includes releases as of 1 December 1991

Stocking location	Area	Species	Hatchery	Broodstock	Lifestage	Number stocked	Average weight (gm)
TOLSONA L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	30,000	1.400
TOLSONA MTN L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	15,000	1.400
TWO MILE L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	3,400	1.400
WOTHINGTON L	PWS	RAINBOW	FT RICHARDSON	SWANSON R	FINGERLING	8,014	1.400
CARLANNA L	SSE	RAINBOW	DEER MOUNTAIN	FT RICHARDSON H	FINGERLING	5,478	4.500
DEER MOUNTAIN H	SSE	RAINBOW	FT RICHARDSON	SWANSON R	FED FRY	96,000	.200
BRUIN L	CCI	SOCKEYE	CROOKED CR H	TUSTUMENA L	EMERGENT F	250,000	.216
TUSTUMENA L	CCI	SOCKEYE	CROOKED CR H	TUSTUMENA L	EMERGENT F	6,000,000	.235
L KITOI L	KOD	SOCKEYE	KITOI H	U STATION L	FINGERLING	1,250,000	2.500
SPIRIDON L	KOD	SOCKEYE	PILLAR CREEK H	U STATION L	FED FRY	3,313,800	.230
CHENIK L	LCI	SOCKEYE	CROOKED CR H	TUSTUMENA L	EMERGENT F	2,100,000	.432
ENGLISH BAY L	LCI	SOCKEYE	BIG LAKE H	ENGLISH BAY	FINGERLING	255,071	.217
HAZEL L	LCI	SOCKEYE	CROOKED CR H	TUSTUMENA L	EMERGENT F	1,300,000	.227
KERSHNER L	LCI	SOCKEYE	CROOKED CR H	TUSTUMENA L	EMERGENT F	250,000	.216
L PAINT L	LCI	SOCKEYE	CROOKED CR H	TUSTUMENA L	EMERGENT F	250,000	.216
LEISURE L	LCI	SOCKEYE	CROOKED CR H	TUSTUMENA L	EMERGENT F	2,000,000	.227
U PAINT L	LCI	SOCKEYE	CROOKED CR H	TUSTUMENA L	EMERGENT F	500,000	.216
BIG L (BIG L)	NCI	SOCKEYE	BIG LAKE H	MEADOW CR	FED FRY	1,594,000	.237
MEADOW CR	NCI	SOCKEYE	BIG LAKE H	MEADOW CR	EMERGENT F	259,000	.155
MEADOW CR	NCI	SOCKEYE	BIG LAKE H	MEADOW CR	FED FRY	8,184,256	.223
CRESCENT L	NSE	SOCKEYE	SNETTISHAM CIF	CRESCENT L	EMERGENT F	388,460	.200
CRESCENT L	NSE	SOCKEYE	SNETTISHAM CIF	CRESCENT L	PRESMOLT	69,193	
SWEETHEART L	NSE	SOCKEYE	SNETTISHAM CIF	SPEEL L	EMERGENT F	1,310,104	.200
TAHLTAN L	OUT	SOCKEYE	SNETTISHAM CIF	TAHLTAN L	EMERGENT F	3,584,471	.130
U TATSAMENIE L	OUT	SOCKEYE	SNETTISHAM CIF	LOWER TATSAMENI	EMERGENT F	673,236	.170
U TRAPPER L	OUT	SOCKEYE	SNETTISHAM CIF	LITTLE TRAPPER	EMERGENT F	933,791	.160
COGHILL L	PWS	SOCKEYE	MAIN BAY H	COGHILL L	SMOLT	443,000	10.300
ESHAMY L	PWS	SOCKEYE	MAIN BAY H	ESHAMY L	SMOLT	872,492	7.200
EYAK L	PWS	SOCKEYE	MAIN BAY H	EYAK L	SMOLT	47,609	2.800
GULKANA E FORK	PWS	SOCKEYE	GULKANA II H	GULKANA E FORK	EMERGENT F	765,902	.160
MAIN BAY	PWS	SOCKEYE	MAIN BAY H	COGHILL L	SMOLT	2,363,337	9.408
PAXSON L	PWS	SOCKEYE	GULKANA I H	GULKANA E FORK	EMERGENT F	10,522,819	.160
SUMMIT L (PAX)	PWS	SOCKEYE	GULKANA I H	GULKANA E FORK	EMERGENT F	12,219,666	.160
KLAWOCK L	SSE	SOCKEYE	KLAWOCK H	KLAWOCK L	FED FRY	196,846	1.706
KLAWOCK L	SSE	SOCKEYE	KLAWOCK H	KLAWOCK L	FINGERLING	19,733	12.300
CROOKED CR	CCI	STEELHEAD	CROOKED CR H	CROOKED CR	SMOLT	68,948	70.000

Appendix 1. Salmonids stocked by FRED Division in 1991

1/16/92: Includes releases as of 1 December 1991

Stocking location	Area	Species	Hatchery	Broodstock	Lifestage	Number stocked	Average weight (gm)
ELEPHANT L	CCI	STEELHEAD	CROOKED CR H	CROOKED CR	FINGERLING	45,000	14.000
CRYSTAL CR	CSE	STEELHEAD	CRYSTAL LAKE H	CRYSTAL CR	SMOLT	2,177	66.470
KLAWOCK R	SSE	STEELHEAD	KLAWOCK H	KLAWOCK R	SMOLT	17,235	122.550
ONE DUCK L	SSE	STEELHEAD	KLAWOCK H	KLAWOCK R	SMOLT	1,000	227.000
THOMAS BASIN	SSE	STEELHEAD	DEER MOUNTAIN	KETCHIKAN CR	SMOLT	5,021	45.700
WARD L	SSE	STEELHEAD	KLAWOCK H	KLAWOCK R	SMOLT	12,047	46.000

APPENDIX 2

1991 Average Commercial Salmon Fishery Harvest Weights

Appendix 2. 1991 Average Commercial Salmon Fishery Harvest Weights

Data is preliminary (12/18/91)

AREA	SPECIES	AVG HARVEST WEIGHT (LB)
ARCTIC/YUKON/KUSKOKWIM		
(includes only Kotzebue area)		
	Chum	8.1
COOK INLET		
	Chinook	20.65
	Sockeye	5.41
	Coho	6.12
	Pink	2.61
	Chum	7.25
KODIAK		
	Chinook	12.14
	Sockeye	5.11
	Coho	7.26
	Pink	2.92
	Chum	6.98
AK PENINSULA		
	Chinook	16.44
	Sockeye	5.57
	Coho	6.92
	Pink	3.14
	Chum	6.45
PRINCE WILLIAM SOUND		
	Chinook	20
	Sockeye	6.1
	Coho	9
	Pink	2.5
	Chum	9
SOUTHEAST		
	Chinook	16
	Sockeye	6.2
	Coho	6.4
	Pink	2.71
	Chum	8.5

Data is based on total commercial fishery. Data from Division of Commercial Fisheries.

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